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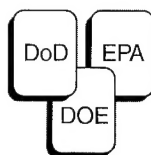
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SERDP

Strategic Environmental Research
and Development Program

SERDP Scientific Advisory Board

ANNUAL REPORT TO CONGRESS

Fiscal Year 1999



March 2000



ANNUAL REPORT TO CONGRESS— FISCAL YEAR 1999

FROM THE STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM

March 2000

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FOREWORD

During Fiscal Year (FY) 1999, the Scientific Advisory Board (SAB) continued and expanded its activities and involvement with the Strategic Environmental Research and Development Program (SERDP). The Board reviewed 11 continuing projects, valued at \$11.35 million, and 19 FY 1999 and FY 2000 new start proposals valued at \$8.32 million. In addition to reviewing SERDP projects and proposals in FY 1999, the SAB also received informational briefings on the Department of Defense's (DoD) Groundwater Modeling System and on the SERDP-supported Ecosystem Management Program, known as SEMP.

While rigorous review of individual projects and proposals continues to be central to the Board's role, the implementation of a successful peer review program by SERDP has enabled the SAB to devote more of its attention to higher level review and integration of the Program. The Board has emphasized the active involvement of research efforts from individual projects into integrated and coordinated research partnerships, including increased use of technical advisory committees and establishment of research consortia. A continuing theme in the Board's review, especially as projects mature, is participation of the technology's intended end-user. As demonstration of user interest, the Board paid particular attention to the direct or in-kind resources contributed by the ultimate recipient military Service as the project progressed and the extent of user involvement in planning for project transition to follow-on demonstration/validation or to the field.

The June 1999 Air Emissions Compliance workshop conducted by SERDP, in cooperation with the American Academy of Environmental Engineers, was a tremendous success. The planning and participation of members of the SAB was elemental to this success. The workshop enabled air quality specialists to investigate research opportunities to reduce and control air emissions from diesel and gas engines and ordnance sources. As a result of this workshop, four separate Statements of Need requesting proposals involving air emission characterization, reduction, and elimination have been issued for possible FY 2001 new start projects. This and preceding workshops have played a key role in identifying strategic environmental research and development opportunities, and the Board strongly supports the workshop concept as it has been implemented by SERDP in recent years.

As the SAB Chair, I had the opportunity to brief the SERDP Council at their September 1999 meeting regarding the SAB perspective on various aspects of SERDP. In my remarks, I stressed that SERDP has evolved into one of the nation's most productive and state-of-the-art programs and that the Program is clearly focused on Department of Defense and national needs.

The Board is encouraged by SERDP's continued efforts in FY 1999 to enhance technical quality, focus on strategic environmental issues, and allocate scarce resources on the basis of sound technical and fiscal criteria. The Board vigorously supports SERDP as a strong scientific program and a solid public investment.



C. Herb Ward
Chair, FY 1999
SERDP Scientific Advisory Board

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EXECUTIVE SUMMARY

Section 2904(h) of title 10, United States Code (U.S.C.), requires the Strategic Environmental Research and Development Program Scientific Advisory Board to submit an annual report to Congress no later than March 15 of each year. The Annual Report is required to describe the actions of the SAB during the preceding year and to provide any recommendations, including recommendations related to projects, programs, information exchange, and additional legislation, within the scope of SERDP. This is the eighth Annual Report submitted by the SERDP SAB and includes activities and Program recommendations made by the SAB during FY 1999.

During FY 1999, the Board continued to emphasize the strategic role of SERDP in general and the essential function of the SAB to guide SERDP activities toward building a scientifically sound and strategically focused program. The Board recognizes the unique position of SERDP as the "strategic" defense environmental research and development program. To this end, the SAB reaffirmed the position that a SERDP project should focus on research that is;

- essential for the solution of a major defense mission-readiness related problem;
- scientifically plausible;
- targeted to areas where progress under other program sponsorship in the Department of Defense and/or other agencies is not sufficient or satisfactory;
- catalytic in nature to initiate, organize, and accelerate essential research in partnership with the Federal and private sector; and
- capable of providing sufficient proof-of-principle demonstrations to attract follow-on Research, Development, Test & Engineering support.

As a group, the SAB reviewed and provided funding recommendations for 30 projects with a total value in excess of \$19.7 million. While maintaining its commitment to provide a rigorous review of individual projects and proposals, the Board has been able, through the implementation of a successful peer review process, to devote more of its attention to higher level review and integration of the Program as a whole. The Board has emphasized the active evolution of research efforts from individual projects into integrated and coordinated research project consortia. This emphasis ensures that projects not only possess individual scientific merit and DoD relevance, but also that sufficient coordination and leveraging exists between projects to ensure that related efforts indeed compliment each other.

The establishment and continued participation of Technical Advisory Committees (TAC) also has played a large role in the development of a more integrated program. The Board endorses the use of such TACs to provide technical oversight for major projects or multiple efforts that address the same subject area. Examples include the Federal Integrated Biotreatment Research Consortium (FIBRC), the Next Generation Fire Suppression Technology Program, and the SERDP Ecosystem Management Program (SEMP). In actions supported by the SAB, the FIBRC and SEMP TACs were expanded in FY 1999 to encompass larger areas of influence.

The Board also emphasized its commitment to technology transfer by strongly encouraging the eventual users of technologies, specifically the three Services, to provide support and, given successful development, reasonable assurances of cooperative funding in the project's later years. The SAB is working to ensure that

the ultimate recipient military Service or Federal agency contributes direct or in-kind resources as the project progresses and the user become increasingly involved in planning for project transition into the field.

During FY 1999, the Executive Director continued to involve the SAB members fully in most management issues. The Board's influence on the Program extended beyond the routine process of approving projects that exceed a funding threshold. The Executive Director encouraged the SAB to continue to participate in the following activities:

- provide recommendations in the project selection process;
- identify opportunities for technology development;
- foster technology transfer between the private sector and governmental agencies;
- determine feasibility and applicability of using Federal monitoring systems and data resources for environmental purposes, especially in the conservation of land resources arena; and
- participate in overall strategy formulation and program management issues.

Specific examples of this extended involvement included the direction and participation provided by several members of the Board in a workshop on air emissions compliance that was held in June of 1999, in cooperation with the American Academy of Environmental Engineers. The focus of the workshop was on the reduction and control of air emissions from diesel and gas engines and ordnance sources, and it has resulted in the solicitation of new research efforts to be started in FY 2001. Also, the vast collective experience of the SAB led its members to a conclusion that the DoD would benefit from improved environmental full cost accounting as has been conducted in the chemical industry, among others. Efforts are already under way for a technical workshop involving environmental full cost accounting to be held in late 2000 or early 2001.

Representing a diverse membership from a host of professional backgrounds and areas of recognized expertise from this nation's scientific community, the SERDP Scientific Advisory Board provides a balanced and forward-looking perspective in all phases of its work. The Executive Director continues to foster the resultant synergism that is created by the gathering of experts from such diverse disciplines. The role of the SAB is strengthened further by the annual appointment of new members who rejuvenate the Board and add important new areas of specialized scientific knowledge.

Looking ahead to the future, the SAB will continue to take advantage of the expertise and knowledge of its members to strengthen the strategic role of SERDP and identify emerging environmental areas of opportunity that can benefit SERDP, defense program managers, and the environmental community at large.

ORGANIZATION

THE SERDP MANAGEMENT STRUCTURE

SERDP is a multi-agency (Department of Defense, Department of Energy, Environmental Protection Agency) managed program funded by the Department of Defense. Pursuant to title 10, U.S.C., SERDP receives general oversight and policy guidance from the SERDP Council which composed of members from the DoD, DOE, and EPA. The SERDP Scientific Advisory Board is charged with providing advice and recommendations to the SERDP Council on projects/proposals reviewed and may advise the Council regarding other programmatic, funding, or technically related issues with respect to the Program.

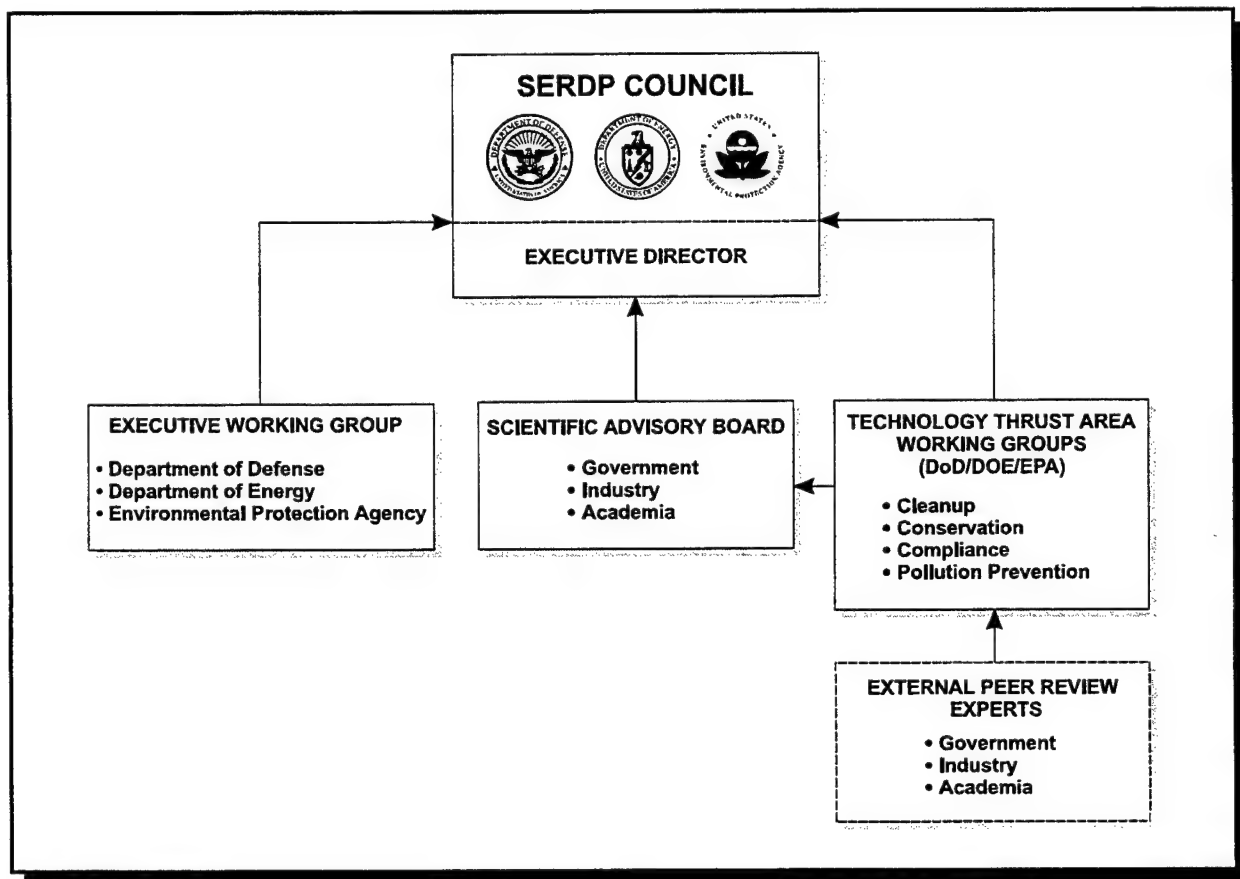


Figure 1 SERDP Organization

During Fiscal Year 1999, Mr. Bradley P. Smith, the Executive Director of SERDP, continued to serve as the Designated Federal Officer attending the SERDP SAB meetings in accordance with the requirements of Subsection 10(e) and (f) of the Federal Advisory Committee Act. Mr. Smith called each of the meetings in the Federal Register, approved the agendas, and attended all four of the scheduled meetings of the SERDP SAB.

SERDP THRUST AREAS

SERDP's Thrust Areas (Cleanup, Compliance, Conservation, and Pollution Prevention) correspond with the four environmental technology Pillars that exist within the Office of the Deputy Under Secretary of Defense for Environmental Security. SERDP seeks to identify and promote technologies that (1) improve cleanup effectiveness and reduce resultant costs to the Department of Defense and Department of Energy; (2) reduce the number of Notices of Violation (NOV) and mitigate the cost impact of the NOVs; (3) improve DoD's capability to maintain force readiness through enhancement of testing and training lands and serve as proper stewards of Federal lands; and (4) eliminate the occurrence of future hazardous and toxic impacts by materials substitution and process modifications.

Cleanup

The principal focus of this area is to develop more cost-effective methods and technologies for remediation, monitoring, characterization, and assessment. Research in this Thrust Area seeks to achieve more efficient, effective environmental cleanup of soil, sediment, groundwater, surface water, and structures already contaminated by past practices with hazardous materials, such as unexploded ordnance and toxic substances.

Compliance

Compliance research and development includes technologies supporting both environmental monitoring and waste treatment/disposal, as well as environmental management related to meeting current and future environmental compliance requirements. Other issues addressed include understanding the fate and transport of defense-related air and waste water discharges and end-of-pipe recycling, i.e., waste that is recycled for other than its original purpose.

Conservation

There is a growing need to use and maintain training and testing facilities effectively to support environmental and operational requirements. Management of natural resources is an important consideration in maintaining the use of these facilities to provide the realistic training environment in which to exercise and test the capabilities of the military forces. Therefore, efforts in this Thrust Area have focused on research to understand, protect, and maintain natural resources in order to ensure;

- compliance with environmental laws [such as the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA)];
- sustainable use of land and coastal resources;
- support for the stewardship of those resources on relevant Federal lands.

Research efforts are intended to identify and predict effectively the presence, quantity, and quality of natural and cultural resources; improve the knowledge of the basic natural land and coastal processes as they relate to, and are impacted by, use of lands; and advance the technology to mitigate, rehabilitate, and maintain these resources.

Pollution Prevention

The goal of this Thrust Area is to reduce or eliminate the creation of pollutants, thereby decreasing the need for their treatment and disposal and reducing the cost of compliance with future environmental regulations. During FY 1999, research focused on;

- identifying alternatives for or minimizing the use of hazardous and toxic chemicals/materials;
- identifying alternative processes or technologies that result in fewer pollutants;
- improving the efficiencies of mechanical and chemical systems;
- assessing the life-cycle effects of materials and systems.

The application of pollution prevention initiatives will influence the other SERDP Thrust Areas positively by encouraging the use of innovative, pollution-reducing technologies and practices.

FY 1999 SAB MEMBERSHIP

Section 2904(a-c) of title 10, U.S.C. requires the joint appointment of members of the Scientific Advisory Board by the Secretary of Defense and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency. Members were solicited and nominated in accordance with the statute from the three participating agencies, the National Academy of Sciences, the Council on Environmental Quality, and the National Association of Governors. With regard to the SAB Membership, the statute requires that

- one member shall be the Science Advisor to the President, or his/her designee;
- one member shall be the Administrator of the National Oceanic and Atmospheric Administration (NOAA), or his/her designee;
- at least one member shall be a representative of environmental public interest groups; and
- at least one member shall be a representative of the interests of State governments.

SAB Members and Affiliations

| | | |
|------------------------------------|---|---|
| Dr. C. Herb Ward, Chair | — | Rice University |
| Dr. Jean'ne M. Shreeve, Vice Chair | — | University of Idaho |
| Dr. Braden R. Allenby | — | AT&T |
| Dr. Patrick R. Atkins | — | Aluminum Company of America |
| Dr. Mary C. Barber | — | Ecological Society of America |
| Dr. Rosina M. Bierbaum | — | Office of Science and Technology Policy |
| Dr. Paul L. Busch ^(†) | — | Malcolm Pirnie, Inc. |
| Dr. Steven F. Clifford | — | National Oceanic and Atmospheric Administration |
| Dr. Kenneth L. Dickson | — | University of North Texas |
| Dr. Raymond C. Loehr | — | University of Texas |
| Dr. Perry L. McCarty | — | Stanford University |
| Dr. Roger O. McClellan | — | Chemical Industry Institute of Toxicology |
| Mr. Robert S. Winokur | — | National Oceanic and Atmospheric Administration |
| Mr. Randolph Wood | — | Nebraska Department of Environmental Quality |
| Dr. Lily Y. Young | — | Rutgers University |

^(†) deceased

Exhibit 1 - Membership of the SERDP Scientific Advisory Board During FY 1999

Exhibit 1 lists the members of the Board during FY 1999. Appendix A contains short biographies of each SAB member.

The Board noted with sadness the passing of Dr. Paul Busch. Dr. Busch was well known in his field. While he was newly appointed to the Board in FY 1999, it was apparent that he was a strong and visionary leader in the environmental community. His presence was and will continue to be missed.

The year began with 13 members on the Board; however, with the resignations of both Dr. Roger McClellan and Dr. Robert Winokur and the passing of Dr. Paul Busch, the Board was left with 12 members at the year's end. Dr. C. Herb Ward and Dr. Jean'ne Shreeve served as SAB Chair and Vice Chair, respectively, for FY 1999. Dr. Ward was reelected to serve a second term, and Dr. Shreeve was reelected to serve a third term. During this fiscal year, Dr. Rosina Bierbaum continued to serve as the designee for the Science Advisor to the President, and Mr. Randolph Wood continued to represent the interests of State governments. Mr. Robert Winokur and Dr. Steven Clifford served as the statutory members representing the Administrator of the National Oceanic and Atmospheric Administration, and Dr. Mary Barber represented environmental public interest groups. New appointees included Dr. Braden Allenby, Dr. Mary Barber, Dr. Paul Busch, Dr. Kenneth Dickson, and Dr. Lily Young.

The members effectively used a subcommittee structure in order to utilize members' expertise and time more efficiently in the review of the 30 projects that were brought before the SAB during FY 1999. This also allowed a more effective means to handle more detailed information on specific projects and to provide follow-on review of issues and questions raised during the project review process. Exhibit 2 lists the subcommittee membership.

| CLEANUP: | COMPLIANCE: | CONSERVATION: | POLLUTION PREVENTION: |
|-----------------|--------------------|----------------------|------------------------------|
| Paul Busch | Braden Allenby | Mary Barber | Braden Allenby |
| Kenneth Dickson | Patrick Atkins | Rosina Bierbaum | Patrick Atkins |
| Raymond Loehr | Mary Barber | Steven Clifford | Paul Busch |
| Perry McCarty | Rosina Bierbaum | Kenneth Dickson | Perry McCarty |
| Roger McClellan | Steven Clifford | Robert Winokur | Roger McClellan |
| Jean'ne Shreeve | Robert Winokur | Randolph Wood | Jean'ne Shreeve |
| Herb Ward | Randolph Wood | Herb Ward | Raymond Loehr |
| Lily Young | | Lily Young | |

Exhibit 2 - SAB Subcommittees

ACTIVITIES AND RECOMMENDATIONS

ACTIVITIES

Meetings

In accordance with Section 2904, title 10, U.S.C., the Scientific Advisory Board is required to meet a minimum of four times during the Fiscal Year. In FY 1999, the SAB met four times, and all four meetings were held in Arlington, VA.

During FY 1999, the SAB reviewed all research proposed with funding requests in excess of \$900,000 as well as all new start proposals selected for funding. Consistent with the statute, the Board made recommendations to the SERDP Council through the Executive Director regarding the projects reviewed. They also assisted and advised the Council in identifying environmental opportunities and provided advice on other environmental issues within the scope of SERDP.

Table 1 provides a list of dates and locations of all SAB meetings held during FY 1999. In accordance with the Federal Advisory Committee Act, all meetings were open to the public and detailed records of events are maintained. Further, all records, reports, working papers, and agendas were made available to the public for review. In FY 1999, no requests were made to review this information.

| SAB Meeting No. | Dates | Location | Projects Briefed | | |
|-----------------|--------------------|---|------------------|------------|-------|
| | | | Ongoing | New Starts | Total |
| 1 | October 29, 1998 | Arlington Hilton Hotel Arlington, VA | 3 | 3 | 6 |
| 2 | March 16-17, 1999 | National Rural Electric Cooperative Association Arlington, VA | 5 | 2 | 7 |
| 3 | August 11-12, 1999 | Holiday Inn at Ballston Arlington, VA | - | 10 | 10 |
| 4 | September 15, 1999 | National Rural Electric Cooperative Association Arlington, VA | 2 | 5 | 7 |

Table 1 - Summary of FY 1999 SAB Meetings

Commitment to Focus on the "Strategic" Nature of SERDP

Consistent with the SAB's desire to define and fulfill its role within SERDP's statutory requirements, in a manner that most effectively utilizes the collective expertise and experience of the Board, the SAB reaffirmed its commitment to ensure that SERDP focuses on issues of a strategic nature. The Board agreed that part of its mission is to provide SERDP with strategic, directional guidance and ensure that projects have embodied a sound technological and programmatic approach. To further their opportunity to provide this strategic guidance, the SAB not only reviewed SERDP projects and proposals at each of the meetings,

but also received informational briefings on the Department of Defense's (DoD) Groundwater Modeling System (GMS) and on the SERDP-supported Ecosystem Management Program, known as SEMP.

The Board continued its proactive strategic role in identifying and defining environmental research gaps and associated technology development opportunities. The Board continued to support strongly the concept of focused technical workshops to provide an assessment of the state of the science and identify and prioritize research needs specific in areas of interest to SERDP. The Air Emissions Compliance workshop conducted by SERDP, in cooperation with the American Academy of Environmental Engineers, in June of 1999, was a tremendous success, due in large part to the involvement of the SAB, both in identifying the workshop topic and as a result of the planning and active participation of individual SAB members. This workshop assembled air quality specialists to investigate technical issues and identify research opportunities for SERDP to reduce and control air emissions from diesel and gas turbine engines and ordnance sources. As a result of this workshop, four separate Statements of Need requesting proposals involving air emission characterization, reduction, and elimination have been issued for possible FY 2001 new start projects. Moreover, the FY 2001 solicitation includes Statements of Need related to biodegradation of nitroaromatics and in-situ mixing in groundwater which directly correspond to research needs articulated in an SAB-initiated workshop held in FY 1998. Finally, the Executive Director provided the entire Board membership a chance to review each Statement of Need prior to their inclusion in SERDP's Broad Agency Announcement and Federal Call For Proposals for the FY 2001 solicitation.

Commitment to Ensuring Quality Research

Coupled with its emphasis on strategic research, the Board's key focus continued to be assisting SERDP in ensuring SERDP-supported projects meet the highest standard of technical and scientific quality. The SAB addressed this issue from several avenues.

- First, the members strongly endorsed the established solicitation and proposal review process. The SAB firmly supports SERDP's goal to embrace the widest competition possible through direct participation of non-Federal research capabilities. As illustrated by the FY 1999 competition, the Federal, academic, and private industrial sectors each contributed well to the overall Program content. In their review of new start proposals, the Board received extended introductory briefings from the SERDP staff and, in many cases, quizzed the Executive Director and his staff on the scope of the DoD problem being addressed by the proposed new start projects, the efforts already under way, and the specific scientific and technology gaps that would be filled by the proposed efforts.
- Second, the members encouraged close coordination between projects that address related problems. In this sense, the Board evaluated projects on more than just the basis of their individual scientific merit and DoD relevance, putting increasing emphasis on coordination and leveraging between projects to ensure that related efforts indeed complement each other. As demonstration of this emphasis, the Board voiced its support for the use of a Technical Advisory Committee for "umbrella"-type projects, i.e., those that are a conglomeration of subprojects and centrally managed by a laboratory or agency representative. Projects in this category include the Federal Integrated Biotreatment Research Consortium, the Next Generation Fire Suppression Technology Program, and the SERDP Ecosystem Management Program. The Board supported the decision by the SERDP Executive Director to broaden the mandate of the FIBRC TAC to include review of all SERDP bioremediation efforts. Regarding the SEMP, the Board recommended that the TAC broaden its participation to include individuals from outside Department of Defense and Department of Energy and extend communication with other environmental and academic communities.

- Third, the Board fully supported the mid-year In-Progress Review of each project by the Technical Thrust Area Working Groups (TTAWG). While the SAB's primary function is to assess the technical aspects of SERDP projects, the Board has insufficient time to conduct a thorough technical evaluation of each ongoing project. The TTAWG is the appropriate group to perform this assessment. However, the SAB Chair, Dr. Ward, and other members did attend and participate in some of the mid-year review meetings.

In a related matter, the SAB acknowledges that specific projects are funded at the recommendation of Congress. These projects were briefed to the Board, and the SAB appreciates the opportunity to assess these projects and offer suggestions to strengthen the effort; however, the Board is concerned that its review of these projects should not be viewed as a tacit endorsement. While the Board did recognize some limited elements of merit in the two congressionally directed efforts funded by SERDP in FY 2000, the Board did recommend against funding both projects on the basis of a lack of relevance and/or technical merit.

Commitment to Technology Transfer

The SAB continued to emphasize technology transfer potential as an important criterion for evaluating proposals. Technology transfer is one of the SERDP Keys to Success, and the Board members continued their keen interest in the role of the military Services and eventual users of the technologies being developed.

The Board views participation of the intended technology user(s) as one of the surest signs that a project is focused on relevant issues and a demonstration of the user interest and willingness to transfer and implement a new technology at the conclusion of SERDP's funding. During their review of proposals and ongoing projects, the SAB members asked each Principal Investigator what contributions the military Service of interest was making. As each project matured in its SERDP lifetime, the SAB expected an increased amount of leveraged funding in the support of the effort, as evidence of the interest and commitment of the eventual users of the technology. As appropriate, the SAB requested project investigators to more aggressively pursue leveraging contributions and/or more clearly demonstrate technology transfer efforts and involvement of the user community.

In FY 1999, the SAB concentrated on two primary aspects of technology transfer

- 1) Service participation in each SERDP effort from start to project conclusion
- 2) Accountability of each project with regard to preparation and distribution of appropriate technical documentation.

Complete technical reporting, including publications in the peer-reviewed literature as well as SERDP-required interim and final technical reports, was a metric used to determine project technical achievement and management acumen. The SAB fully supported SERDP's requirement for annual/interim technical reports and a final technical report upon completion of the project. These reports constitute technical progress to date, whether successful or not, on each project's technical approach. According to the Board, the value of "negative results" cannot be overstated, and SERDP projects should clearly state their progress and publish these results to facilitate further research.

The SAB continued its participation in the planning and execution of the annual *Partners in Environmental Technology* Technical Symposium and Workshop sponsored by SERDP. During strategy discussions at SAB meetings, the members offered comments on the overall theme of the Symposium and suggestions for technical session topics and plenary and session speakers. SAB members continued the tradition of active involvement in the planning and execution of breakout sessions. At the December 1998 event, Dr. Rosina Bierbaum and Dr. Braden Allenby served as Plenary Session speakers. Dr. Raymond Loehr served as Chair

and Keynote speaker for the Environmentally Acceptable Endpoints technical session, and Dr. Herb Ward and Dr. Perry McCarty served as Co-Chairs of the DNAPL and Chlorinated Solvents technical session. The active involvement of the SAB was a significant contributing factor to the overall success of the Symposium. The Board continued to demonstrate its commitment to involvement at the latest Symposium held in December 1999, with four members serving as technical session Chairs (Dr. Braden Allenby, Dr. Patrick Atkins, Dr. Raymond Loehr, and Dr. Perry McCarty) and Dr. Herb Ward serving as Keynote speaker in the technical session on New Cleanup Protocols.

RECOMMENDATIONS

Areas of Opportunity

The Board's proactive role in providing strategic guidance to SERDP in identifying needs and corresponding research opportunities culminated in a workshop held in June of 1999 on air pollutant emissions from military diesels, turbine engines, and ordnance systems. This workshop brought together 68 renowned engineering and scientific experts, DoD and industry representatives, and Federal and state regulators to identify air emissions research needs for DoD. Dr. Patrick Atkins, Director of Environmental Affairs for Alcoa and SERDP Science Advisory Board Member, moderated the workshop. As mentioned previously, the workshop has already resulted in four focused Statements of Need for the FY 2001 SERDP proposal solicitation.

During FY 1999 the SAB devoted considerable energy to reviewing candidate topic areas for future workshops. This discussion resulted in a recommendation to the SERDP Executive Director to convene a workshop during FY 2000 devoted to environmental full cost accounting. The interest in this topic as a strategic SERDP issue is consistent with the Board's increasing emphasis to view and evaluate projects and proposed technologies in a more holistic framework that considers a product or technology's entire life cycle and views the benefits derived from a SERDP investment relative to the entire life cycle environmental cost of a current weapon system of DoD process. This approach also considers and balances benefits at one specific phase of the life cycle process, which are often the impetus for and focus of a SERDP project, against the potential for new and different adverse environmental impacts that may arise elsewhere if a new technology is actually implemented. A workshop on environmental full cost accounting is planned for late 2000 or early 2001. Similar to previous SERDP workshops, it will assess the state of the science, identify gaps in technical knowledge, and determine strategic investment opportunities for DoD/SERDP.

Consistent with past practice, the Executive Director solicited the advice of the membership regarding his proposed allocation of funds among the four Thrust Areas for FY 1999. The Board was fully supportive of the proposed profile and general trends of investment within each of the four Thrust Areas.

Project Recommendations

During FY 1999, the SAB reviewed 30 proposals, 19 of which were new start efforts and 11 of which were continuing projects (see Table 2). Of these 30 proposals, 8 requested FY 1999 funds totaling \$7,016,000 and the remaining 22 projects requested \$12,657,000 of FY 2000 funds. The Board recommended against funding two Congressional Earmark projects and funding for one proposal (PP-1058: Elimination of Toxic Materials and Solvents from Solid Propellant Components) was deferred by the Board in FY 1999. A summary of all projects reviewed, the results of their deliberations, and comments associated with this review may be found in Appendix B.

| Thrust Area | Number of Projects Reviewed | | | Funding Recommendation | |
|----------------------|-----------------------------|-----------|-------|------------------------|-------------|
| | Ongoing | New Start | Total | Fund | Do Not Fund |
| Cleanup | 3 | 7 | 10 | 9 | 1 |
| Compliance | 3 | 7 | 10 | 9 | 1 |
| Conservation | 1 | 4 | 5 | 5 | 0 |
| Pollution Prevention | 4 | 1 | 5 | 4 | 1 |
| TOTAL | 11 | 19 | 30 | 27 | 3 |

Table 2 - Summary of Proposals Reviewed by Thrust Area

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APPENDIX A

FY 1999 SAB MEMBERSHIP

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Ward, Herb C. (SAB Chair)

- Current Position:** Foyt Family Chair of Engineering, Professor of Environmental Science and Engineering and of Ecology and Evolutionary Biology, Rice University; Director, Advanced Applied Environmental Technology Demonstration Facility, U.S. Department of Defense; Director, Energy and Environmental Systems Institute, Rice University; Co-Director, Hazardous Substances Research Center - South and Southwest (Louisiana State University, Rice University, Georgia Institute of Technology), U.S. Environmental Protection Agency (EPA) Superfund Research Center.
- Degree(s):** M.P.H., Environmental Health, The University of Texas, 1978; Ph.D., Plant Pathology - Physiology, Cornell University, 1960; M.S., Plant Pathology - Genetics, Cornell University, 1958; B.S., Biology, New Mexico State University, 1955.
- Previous Positions:** Professor and Chair, Department of Environmental Science and Engineering, Rice University, 1970-1992; Visiting Professor, The University of Texas School of Public Health, 1973-1974; Associate Professor, Environmental Science and Engineering Program (1968-1970), and Department of Chemical Engineering (1966-1968), Rice University; Physiologist and Director, Bioregenerative Life Support Systems Research, U.S. Air Force (USAF) School of Aerospace Medicine, 1963-1966; Research Scientist, USAF School of Aerospace Medicine, 1960-1963.
- Professional Activities:** Committee Chair and Member, National Academy of Science, National Academy of Engineering, and National Research Council, 1975-present; Editor-in-Chief, *Environmental Toxicology & Chemistry*, 1981-present; Committee Chair and Member, EPA Science Advisory Board, 1987-present; Member, U.S. Department of Defense Strategic Environmental Research and Development Program (SERDP) Bioconsortium Science Advisory Committee, 1997-present and National Environmental Technology Test Sites Program Review Panel, 1994-1999; Consultant, Environmental Sciences Program, University of New Orleans, 1995; Board of Directors, American Type Culture Collection, 1987-1990; President, American Institute of Biological Sciences, 1984-1985; President, Society for Industrial Microbiology (SIM), 1983-1984.
- Awards:** National Distinguished Lecturer, Association of Environmental Engineering and Science Professors, 2000; Founders Award, Society of Environmental Toxicology and Chemistry (SEATC), 1999; Herb Ward Exceptional Service Award, SEATC, 1999; Fellow, American Academy of Microbiology, 1994; Controlled Ecological Life Support Systems Award, National Aeronautics and Space Administration (NASA), 1993; Exceptional Service Award, Society of Environmental Toxicology and Chemistry, 1990; Charles Porter Award, SIM, 1986; Achievement Award, NASA, 1981.
- Publications:** Author or co-author of more than 200 publications and 22 books.

Shreeve, Jean'ne M. (SAB Vice Chair)

- Current Position:** Vice President for Research/Graduate Studies and Professor of Chemistry, University of Idaho.
- Degree(s):** Post Ph.D., University of Cambridge, England, 1967-1968; Ph.D., Inorganic Chemistry, University of Washington, 1961; M.S., Analytical Chemistry, University of Minnesota, 1956; B.A., Chemistry, University of Montana, 1953.
- Previous Positions:** Professor and Head, Department of Chemistry, University of Idaho, 1973-1987; Assistant Professor of Chemistry, University of Washington, 1962.
- Professional Activities:** EPSCoR, Idaho State Project Director, 1989-1999; Idaho Research Foundation, 1987-1999; University of Chicago Board of Governors of Argonne National Laboratory, 1992-1998; Council for Chemical Research Governing Board, 1995-1997; Board of Directors, American Association for the Advancement of Science, 1991-1995; Visiting Committee, Naval Research Advisory Committee, Office of Naval Research, 1995; Board of Directors, American Chemical Society, 1985-1993; National Science Foundation Advisory Committee for Chemistry, 1978-1982; Air Force Office of Scientific Research Proposal Evaluation Panel, 1972-1975.
- Awards:** Corresponding Member, Göttingen (Germany) Academy of Sciences, 1996; Harry and Carol Mosher Award, Santa Clara Valley Section (ACS), 1992; Honorary Doctor of Science, University of Montana, 1982; Alexander von Humboldt Foundation U.S. Scientist Award, Göttingen, 1978; American Chemical Society Award for Creative Work in Fluorine Chemistry, 1978; Alfred P. Sloan Foundation Fellow, 1970-1972; American Chemical Society Garvan Medal, 1972; Outstanding Achievement Award, University of Minnesota, 1970; National Science Foundation Postdoctoral Fellowship at Cambridge, 1967-1968; U.S. Honorary Ramsay Fellowship, 1967-1968.
- Publications:** Author of more than 290 scientific publications.

Allenby, Braden R.

- Current Position:** Vice President, Environment, Health and Safety, AT&T; Adjunct Professor, Columbia University.
- Degree(s):** Ph.D., Environmental Sciences, Rutgers University, 1992; M.S., Environmental Sciences, Rutgers University, 1989; M.S., Economics, University of Virginia, 1979; J.D., University of Virginia Law School, 1978; Yale University, 1972.
- Previous Positions:** Research Vice President, Technology and Environment, AT&T, 1993-1995; On assignment as Director for Energy and Environmental Systems at Lawrence Livermore National Laboratory, 1995-1997; Environmental Attorney and Senior Environmental Attorney, AT&T, 1984-1993; J. Herbert Holloman Fellow, National Academy of Engineering, Washington, DC, 1992.
- Professional Activities:** Member, Advisory Council for Resources for the Future Center for Risk Management, October 1997-present; Member, Editorial Advisory Board, *Total Quality Environmental Management*, 1995-present; Member, Editorial Board, *Journal of Industrial Ecology*, Massachusetts Institute of Technology, 1995-present; Member, Environmental Law Institute Board of Directors, December 1997-2000; Co-chair, first Gordon Conference on Industrial Ecology, June 1998; Member, Organizing Committee, Columbia University/Princeton University Conference on Basic Research Needs to Achieve Sustainability, January 1998; Co-chair, National Academy of Engineering 1997 Industrial Ecology Workshop, Woods Hole, MA, July 20-22, 1997; Vice-Chair, Institute of Electrical and Electronics Engineers (IEEE) Committee on the Environment; Member, Advisory Committee of the United Nations Environment Program (UNEP) Working Group on Product Design for Sustainability; Former Member, Secretary of Energy's Advisory Board and the Department of Energy (DOE) Task Force on Alternative Futures for the DOE National Laboratories; Co-chair, Steering Committee of the Institute for Corporate Environmental Mentoring, Washington, DC; Member, Virginia Bar Association, American Association for the Advancement of Science, American Geophysical Union, International Society for Ecological Economics, Semiconductor Safety Association, and Institute of Electrical and Electronics Engineers.
- Awards:** National Association for Environmental Management Environmental Excellence Award, 1995; Outstanding Leadership Award for Design for Environment Task Force, American Electronics Association, 1994; Fellow, Royal Society for the Arts, Manufactures, and Commerce; Outstanding Service Award, Industry Cooperative for Ozone Layer Protection, 1990.
- Publications:** Author of numerous articles and book chapters on Industrial Ecology and Design for Environment; column writer, *Journal of Industrial Ecology and Tomorrow*; author or co-author of several engineering textbooks.

Atkins, Patrick R.

Current Position: Director, Environmental Affairs, Aluminum Company of America (Alcoa); Adjunct Professor, University of Pittsburgh.

Degree(s): Ph.D., Environmental Engineering, Stanford University, 1968; M.S., Environmental Engineering, Stanford University, 1965; B.S., Civil Engineering, Stanford University, 1964.

Previous Positions: Director, Environmental Control, Alcoa, 1980-1991; Chief Environmental Engineer, Alcoa, 1982-1984; Manager, Environmental Control, Alcoa, 1973-1980; Assistant Professor, Department of Environmental Health Engineering, The University of Texas, 1968-1972.

Professional Activities: Member, American Society of Civil Engineers, National Society of Professional Engineers, and Engineering Society of Western Pennsylvania; Member, Environmental Committees of the International Primary Aluminum Institute, the Business Roundtable Environmental Services Committee, National Association of Manufacturers, and other national and international groups; Registered Professional Engineer (Texas and Pennsylvania).

Awards: Alcoa Environmental Excellence Award, 1996; Paper of the Year (co-author), American Society of Civil Engineers, 1978.

Publications: Author of more than 50 technical articles and editor of two books.

Barber, Mary C. (Represents environmental public interest groups)

- Current Position:** Director, Ecological Society of America's Sustainable Biosphere Initiative.
- Degree(s):** Ph.D., Ecology and Evolutionary Biology, Johns Hopkins University, 1982; B.A., Biology, Vassar College, 1971.
- Previous Positions:** Acting Executive Director, Ecological Society of America, 1996-1997; Senior Environmental Scientist, Science and Policy Associates, Inc., 1990-1994; Program Manager, Division of International Programs, National Science Foundation.
- Professional Activities:** Founder, Women's Aquatic Network (WAN), Executive Board 1988-present, Member-Anniversary Committee, 1994-1995, Chair-Nominating Committee, 1994, Chair, 1986-1987, Secretary/Editor, 1984-86; Advisor, Women in Science and Engineering (WISE) 1991-present, Chair-WISE Awards Committee, 1986, 1997-1998, Awards Panel Member, 1987-1998; President, The Ocean Coalition, 1995-present; Member, Marine Technology Society and Annual Meeting Executive Committee, 1998, 1992; Marine Technology Society, DC Chapter, Councilor, 1996-1998, President, 1995-1996, Vice President, 1994-1995; Chair, Interagency Committee, 1989-1990, Department of Commerce representative to Committee, 1983-1986; Member, National Academy of Sciences Panel on Monitoring Particulates in the Marine Environment, 1987-1988, 1991-1993; Member, American Association for the Advancement of Science, American Institute of Biological Sciences, American Society of Limnology and Oceanography, AWIS, British Ecological Society, Ecological Society of America, Estuarine Research Foundation, International Society for Ecological Economics, Society for Conservation Biology, and Society for Ecological Restoration; President, DC Chapter, AWIS.
- Awards:** Recipient, Women's Aquatic Network Special 10th Anniversary Year Award, 1995; Fellow, American Association for the Advancement of Science, 1995; Johns Hopkins University Fellowships, 1975-1980.

Bierbaum, Rosina M. (Represents Science Advisor to the President)

- Current Position:** Associate Director for Environment, Executive Office of the President, Office of Science and Technology Policy.
- Degree(s):** Ph.D., Ecology & Evolutionary Biology, State University of New York (SUNY) at Stony Brook; B.A., English and B.S. Biology, Boston College.
- Previous Positions:** Assistant Director for Environment, Office of Science and Technology Policy (OSTP); Senior Analyst, OSTP; Senior Associate, Office of Technology Assessment (OTA); Project Director for Climate Change, OTA; Assistant Project Director for Acid Rain, OTA; Congressional Fellow, OTA; Editorial Fellow, *The Quarterly Review of Biology*; Research Assistant, SUNY, Stony Brook.
- Professional Activities:** American Association for the Advancement of Science, Ecological Society of America, Sigma Xi; Editorial Board, *Consequences*; National Science & Technology Council (NSTC) liaison to U.S. Global Change Research Program; Acting Chair, Committee on Environment & Natural Resources, NSTC; Acting Chair, Environmental Monitoring Initiative Committee on Environmental & Natural Resources (CENR); Member, White House Ecosystem Management Implementation Task Force.
- Awards:** Distinguished Alumni Award, SUNY at Stony Brook, 1996; Received OSTP Merit Awards 1994, 1995; awarded OTA's highest honor--Senior Associate, 1991; elected member Sigma Xi, 1985; Congressional Fellowship, 1980.
- Publications:** Primary author of *Changing by Degree: Steps to Reduce Greenhouse Gases*, 1991, and *Preparing for an Uncertain Climate*, 1993; contributor to nine assessments on environmental issues published by OTA; co-authored and published numerous articles in technical and popular journals; testified before both House and Senate on environmental issues.

Busch, Paul L. ^(†)

Most Recent Position: Chairman, President, and CEO, Malcolm Pirnie, Inc.

Degree(s): Ph.D., Engineering, Harvard University; M.S., Sanitary Engineering, Massachusetts Institute of Technology (MIT); B.S., Humanities and Engineering, Civil Engineering, Massachusetts Institute of Technology.

Previous Positions: Various positions with Malcolm Pirnie, Inc. since 1961.

Professional Activities: Member, National Academy of Engineering; Member, National Research Council (NRC) Board on Environmental Studies and Toxicology; Trustee-at-Large, Board of Control, Water Environment Federation (WEF); Fellow, American Society of Civil Engineers (ASCE); Member, American Water Works Association; Member, WEF; Diplomate and Past President, American Academy of Environmental Engineers (AAEE); Member, American Association for the Advancement of Science, American Chemical Society, New York Academy of Sciences, Advisory Council-School of Civil and Environmental Engineering-Cornell University, Visiting Committee-Department of Civil Engineering-The University of Texas, and Visiting Committee-Department of Civil and Environmental Engineering-MIT; Trustee, Dibner Institute for History of Science and Technology, MIT; Former Board Chairman, Water Environment Research Foundation; Former Member, NRC Board of Radioactive Waste Management; Former Member, NRC Committee on Environmental Research; Former Co-chair, ASCE 1990 Environmental Engineering Conference; Former Member, Steering Committee of WASTECH; Former Member, the U.S. Environmental Protection Agency's National Advisory Council for Environmental Policy and Technology.

Awards: Freese Environmental Engineering Award, ASCE, 1998; Recipient, Gordon Maskew Fair Award, 1991; AAEE, Kappe Distinguished Lecturer designation, 1990.

Publications: Author of more than 100 presentations and publications on a wide variety of topics.

^(†) deceased

Clifford, Steven F. (Represents Administrator, NOAA)

Current Position: Director, Environmental Technology Laboratory, Oceanic and Atmospheric Research, National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, 1986-present.

Degree (s): Ph.D., Engineering Sciences, Dartmouth College, 1969; B.S.E.E., Northeastern University, 1965.

Previous Positions: Chief, Propagation Studies Program Area, Wave Propagation Laboratory, 1982-1986; Physicist and Project Leader for Optical Remote Sensing, Wave Propagation Laboratory, 1969-1982.

Professional Activities: Fellow, Optical Society of America, 1974; Fellow, Acoustical Society of America, 1983; Senior Member, Institute of Electrical and Electronic Engineers, 1990; Member, Commission B and F-International Union of Radio Sciences (URSI), American Physical Society, American Meteorology Society, and American Geophysical Union.

Awards: Elected to the U.S. National Academy of Engineering, 1997; recipient of five NOAA Paper Awards, 1975 (2), 1977, 1989, 1996; recipient of 1998 U.S. Government Meritorious Presidential Rank Award.

Publications: Author of 130 scientific publications.

Dickson, Kenneth L.

- Current Position:** Director, Institute of Applied Sciences, University of North Texas, 1979-present.
- Degree(s):** Ph.D., Aquatic Biology, Virginia Polytechnic Institute and State University, 1971; M.S., Biology, North Texas State University, 1968; B.S., Education (Biology), North Texas State University, 1966.
- Previous Positions:** Regent's Professor of Biological Sciences, University of North Texas Professor in Department of Biological Sciences, January 1987-1990; University of North Texas, Denton, Texas, Research Scientist IV; Director Environmental Systems Program, Institute of Applied Sciences, February 1979-September 1979.
- Professional Activities:** Member, Environmental Advisory Board, U. S. Army Corps of Engineers, 1995-present; President, Texas Academy of Sciences, 1996-1997; Member, U.S. Environmental Protection Agency (EPA) Science Advisory Board, 1986-1995; Chairman, EPA Science Advisory Board, Ecological Processes and Effects Committee, 1988-1995; Chairman, EPA Environmental Biology Peer Review Panel, 1986-1991; President, Society of Environmental Toxicology and Chemistry 1987-1988; Member, American Association of University Professors, American Fisheries Society, Sigma Xi, Society of Environmental Toxicology and Chemistry, Aquatic Ecosystem Health & Management Society, and Water Environment Federation.
- Publications:** Author/editor of more than 23 books/monographs, 73 chapters in books, and 64 technical articles.

Loehr, Raymond C.

- Current Position:** Hussein M. Alharthy Centennial Chair and Professor of Civil Engineering, The University of Texas at Austin.
- Degree(s):** Ph.D., Sanitary Engineering, University of Wisconsin, 1961; M.S., Civil Engineering, Case Institute of Technology, 1956; B.S., Civil Engineering, Case Institute of Technology, 1953.
- Previous Positions:** Liberty Hyde Bailey Professor of Engineering, Cornell University; Professor, Cornell University, joint appointment - Department of Agricultural Engineering and Department of Environmental Engineering; Senior Program Manager, Hazardous Wastes, Environmental Research and Technology, Inc.; Director, Environmental Studies Program, College of Agriculture and Life Sciences, Cornell University; Program Advisor, Effluent Guidelines Division, U.S. Environmental Protection Agency, Washington, DC; Associate Professor and Professor, University of Kansas; Instructor and Assistant Professor, Case Institute of Technology.
- Professional Activities:** Member, National Academy of Sciences, National Academy of Engineering, and National Research Council Committees; Chair, Executive Committee, Science Advisory Board, U.S. Environmental Protection Agency; Other Science Advisory Board Committees; Science Advisory Board Committee, Phosphorous Management Strategies Task Force, International Joint Commission; Scientific Advisory Committee, Advanced Environmental Control Technology Research Center, University of Illinois; Food and Agriculture Organization, United Nations; Advisory Committee, School of Civil and Environmental Engineering, Cornell University.
- Awards:** Simon W. Freese Award, American Society of Civil Engineers, 1999; Thomas R. Camp Medal, Water Environment Federation, 1997; Gordon M. Fair Award, American Academy of Environmental Engineering, 1996; Rachel Carson Award, Society of Environmental Toxicology and Chemistry, 1995; T.H. Feng Distinguished Lecturer in Environmental Engineering, University of Massachusetts, Amherst, MA, 1994; Thomas R. Camp Lecture Award, Boston Society of Civil Engineers, American Society of Civil Engineers, 1992; Joe J. King Professional Achievement Award, The University of Texas at Austin, 1992; Billy and Claude Hocott Distinguished Centennial Engineering Research Award, The University of Texas, 1991; G. Brooks Earnest Lecture Award, Cleveland Section, American Society of Civil Engineers, 1991; Engineering Foundation Faculty Excellence Award, The University of Texas at Austin, 1987; Senior Fulbright-Hays Scholar, New Zealand, 1979; Rudolph Hering Medal, American Society of Civil Engineers, 1969; Water Conservationist of the Year, Kansas Wildlife Federation, 1967.
- Publications:** Author of more than 220 technical publications since 1974.

McCarty, Perry L.

- Current Position:** Silas H. Palmer Professor Emeritus of Civil and Environmental Engineering, Stanford University; Director, Western Region Hazardous Substance Research Center, Stanford University.
- Degree(s):** Sc.D., Sanitary Engineering, Massachusetts Institute of Technology (MIT), 1959; S.M., Sanitary Engineering, Massachusetts Institute of Technology, 1957; B.S., Civil Engineering, Wayne State University, 1953.
- Previous Positions:** Silas H. Palmer Professor, 1975-1999; Chairman, Department of Civil Engineering, Stanford University, 1980-1985; Professor of Civil Engineering, Stanford University, 1967-1975; Associate Professor of Civil Engineering, Stanford University, 1962-1967; Assistant Professor of Sanitary Engineering, MIT, 1958-1962.
- Professional Activities:** Member, Board on Radioactive Waste Management, National Academy of Sciences/National Research Council, 1989-1996; Member, Commission on Geosciences, Resources, and Environment, National Academy of Sciences/National Research Council, 1994-1996; Member, Research Council, Water Environmental Federal Research Foundation, 1989-1995; Chairman, Committee on Remedial Action Priorities for Hazardous Waste Sites, National Academy of Sciences/National Research Council, 1991-1994.
- Awards:** Clarke Prize for Outstanding Achievement in Water and Science Technology, 1997; Fellow, American Academy of Arts and Sciences, 1996; Fellow, American Academy of Microbiology, 1993; Tyler Prize for Environmental Achievement, 1992; Founder's Award for Sustained and Outstanding Contributions to Environmental Engineering Education, Association of Environmental Engineering Professors (AEEP), 1992; Eng. D. (Honorary), Colorado School of Mines, 1992; Engineering-Science Research Award, 1979, 1983, 1992; A.P. Black Research Award, American Water Works Association, 1989; Honorary Member, WPCF, 1989; Outstanding Publication Award, AEEP, 1985, 1988; Fellow, American Association for the Advancement of Science, 1980; Member, National Academy of Engineering, 1977.
- Publications:** Author of more than 300 publications in total, 37 publications and 5 patents during the past 3 years.

McClellan, Roger O.

- Current Position:** President, Chemical Industry Institute of Toxicology; Adjunct Professor, Duke University Medical Center, North Carolina State University, University of North Carolina, University of New Mexico, and Washington State University.
- Degree(s):** Master of Management, University of New Mexico, 1980; Doctor of Veterinary Medicine (with Highest Honors), Washington State University, 1960.
- Previous Positions:** President and Director, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, 1976-1988; Vice President and Director, Research Administration and Director, Inhalation Toxicology Research Institute, Lovelace Foundation for Medical Education and Research, 1973-1978; Director, Fission Product Inhalation Program, Lovelace Foundation for Medical Education and Research, 1966-1973; Scientist, Division of Biology and Medicine, U.S. Atomic Energy Commission, 1965-1966; Senior Scientist and Biological Scientist, Hanford Laboratories, General Electric Company, 1959-1964.
- Professional Activities:** Committee Chair and Member, National Council on Radiation Protection and Measurements, 1971-present; Member, Advisory Council for Center for Risk Management, Resources for the Future, 1987-present; Research Strategies Advisory Committee, 1992-present and Executive Committee, 1974-1994; National Academy of Sciences/National Research Council Committee on Health Risks of Exposure to Radon, 1994-1996; Chair and Member, Clean Air Scientific Advisory Committee, 1987-1994; Chair and Member, President, American Association for Aerosol Research, 1992-1993; Member, Health Research Committee, Health Effects Institute, 1981-1992; Science Advisory Board, U.S. Environmental Protection Agency; Committee on Risk Assessment for Hazardous Air Pollutants, 1991-1994, and Committee on Toxicology, 1979-1987; President, Society of Toxicology, 1985-1986; Editor, *CRC Critical Reviews in Toxicology*.
- Awards:** Honorary Member, and Ambassador of Toxicology, Mid-Atlantic Chapter of Society of Toxicology, 1995; Fellow, Society for Risk Analysis, 1992; Elected Member, Institute of Medicine, National Academy of Sciences, 1990; Honorary Fellow, The Academy of Toxicological Sciences, 1991; Fellow, American Association for the Advancement of Science, 1981; Frank R. Blood Award, 1989, and Arnold J. Lehman Award, 1992, Society of Toxicology; Career Achievement Award, Society of Toxicology Inhalation Specialty Section, 1989; Distinguished Associate Award, Department of Energy, 1987 and 1988; Alumni Achievement Award, Washington State University, 1987; Herbert E. Stokinger Award, American Conference of Governmental Industrial Hygienists, 1985.
- Publications:** Author or co-author of more than 250 publications.

Winokur, Robert S. (Represents Administrator, NOAA)

Current Position: Assistant Administrator, Satellite and Information Services, National Oceanic and Atmospheric Administration (NOAA), Department of Commerce.

Degree(s): M.S., American University; B.S., Rensselaer Polytechnic Institute.

Previous Positions: Technical Director, Office of the Oceanographer of the Navy; Senior Civilian Technical Manager, Navy Operational Oceanography Program; Associate Technical Director, Ocean Science and International Programs, Office of Naval Research; Director, Planning and Assessment, Office of Naval Research; Deputy and Special Advisor, Office of the Deputy Assistant Secretary of the Navy for Antisubmarine Warfare; Special Assistant for Acoustics to the Director, Antisubmarine Warfare and Surveillance Programs, Office of the Chief of Naval Operations; Branch Head and Division Director, Naval Oceanographic Office.

Professional Activities: Fellow, Acoustical Society of America; Former Vice President Technical Affairs, Marine Technology Society.

Awards: Presidential Distinguished Executive and Meritorious Rank Awards for Senior Executives.

Publications: Author of numerous papers and reports on underwater acoustics and naval oceanography.

Wood, Randolph

Current Position: Deputy Director, Office of Policy and Regulatory Development, Texas Natural Resources Conservation Commission.

Degree(s): M.S., Engineering, Southern Methodist University; B.S., Engineering, The University of Texas.

Previous Positions: Director, Nebraska Department of Environmental Quality; Director, Arizona Department of Environmental Quality; Director, Wyoming Department of Environmental Quality; Supervisor, Source Testing Section, Texas Air Control Board; Engineer, General Dynamics Corporation.

Professional Activities: President, STAPPA (organization of Air Pollution Control Administrators); Board of Directors, STAPPA; Executive Secretary, Wyoming Governor's Acid Rain Coordinating Committee; Editorial Advisory Board, *The Environmental Forum*.

Awards: Tribute of Appreciation Award from the U.S. Environmental Protection Agency (EPA) Administrator for air pollution control efforts, 1984; Citizen Participation Award from the EPA Administrator for air pollution control efforts, 1980.

Young, Lily Y.

- Current Position:** Professor II, Biotechnology Center for Agriculture and the Environment and Department of Environmental Science, Cook College, Rutgers University, New Brunswick, NJ; Associate Dean (part-time) of Graduate Studies, Cook College, Rutgers University.
- Degree(s):** Ph.D., Environmental Microbiology, Harvard University, 1972; M.S., Bacteriology, Cornell University, 1967; B.S., Cornell University, Bacteriology, 1965.
- Previous Positions:** Professor, Biotech Center and Environ Sciences, Cook College, Rutgers University, 1992-1998; Res. Professor, New York University (NYU) Medical Center, 1990-1992; Research Associate Professor, Departments of Environmental Medicine and Microbiology, NYU Medical Center, 1980-1990; Assistant Professor, Environmental Engineering Program, Department of Civil Engineering, Stanford University, 1972-1980.
- Professional Activities:** Member, American Society for Microbiology, American Association for the Advancement of Science, American Chemical Society, and Society for Environmental Toxicology and Chemistry; Chair of the Awards Committee, American Society for Microbiology, 1996-1999; Editorial Board, *Biodegradation*, 1997-1999; Co-Chair & Chair, Gordon Research Conference, Applied & Environmental Microbiology, 1997-1999; National Academy of Sciences/ National Research Council (NAS/NRC) Committee on Research Opportunities for the U.S. Environmental Protection Agency, 1996-1998; Scientific Advisory Committee, National Center for Toxicology Research, Food and Drug Administration (FDA), 1994-1997; National Academy of Sciences, NRC Committee on Naval Ship Waste Disposal, 1994-1996; National Academy of Sciences, NRC Committee on Contaminated Marine Sediments, 1993-1996; Invited participant, EC-US Task Force on Environmental Biotechnology, Brussels, 1994; Discussion Leader, Gordon Research Conference, Environmental Engineering, 1994; Invited participant, Workshop Sustainable Development in Urban Areas of the Americas, Santiago, 1994; Chair, organized conference on Biodegradation: *Its Role in Reducing Toxicity and Exposure to Environmental Contaminants* sponsored by NIEHS, 1993. Editorial Boards: *Biodegradation*, 1997-1999; *Applied and Environmental Microbiology*, American Society for Microbiology; *Microbial Ecology*, 1988-1992; Editor, special issue on Xenobiotics in the Environment, *Microbial Ecology*; Manuscript reviewer for *Canadian Journal of Microbiology*, *Environmental Toxicology and Chemistry*, *Archives of Environmental Toxicology*, *Environmental Science and Technology*, and *Archives of Microbiology*.
- Awards:** Fellow, American Association for the Advancement of Science, 1994; Fellow, American Academy of Microbiology, 1993; ISI and Science Watch, one of the 10 most cited papers in Environment and Ecology, 1994 (EVANS PJ, DT MANG & LY YOUNG, 1991). "Degradation of toluene and m-xylene and transformation of o-xylene by denitrifying enrichment cultures," *Appl Environ Microbiol* 57:450-454.
- Publications:** Editor of one book and author of 13 book chapters, more than 65 reviewed papers, and more than 100 presentations and abstracts.

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APPENDIX B

SAB PROJECT ACTIONS DURING FY 1999

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| Project No. | Recommendation | | | | FY99 Meeting Date | | | | New Starts | Continuing Projects |
|---------------|-----------------|-----------------|-----------------|-----------------|----------------------------------|--------|--------|--------|------------|---------------------|
| | Fund | | Not Fund | | 1 | 2 | 3 | 4 | | |
| | FY99 | FY00 | FY99 | FY00 | Oct-98 | Mar-99 | Aug-99 | Sep-99 | | |
| | | | | | Cleanup Thrust Area | | | | | |
| CU-720 | | \$ 2,300 | | | | Mar-99 | | | | • |
| CU-1081 | | \$ 850 | | | | Mar-99 | | | | • |
| CU-1090 | \$ 345 | | | | Oct-98 | | | | | • |
| CU-1141# | | | \$ 2,700 | | Oct-98 | | | | • | |
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| | | | | | Conservation Thrust Area | | | | | |
| CS-1098 | | \$ 1,130 | | | | Mar-99 | | | | • |
| CS-1143 | | \$ 410 | | | | | Aug-99 | | • | |
| CS-1144 | | \$ 311 | | | | | Aug-99 | | • | |
| CS-1145 | | \$ 401 | | | | | Aug-99 | | • | |
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| | | | | | Compliance Thrust Area | | | | | |
| CP-819# | | | \$ 1,700 | | | Mar-99 | | | | • |
| CP-1106 | | \$ 989 | | | | | | Sep-99 | | • |
| CP-1132 | \$ 500 | \$ 1,200 | | | Oct-98 | | | Sep-99 | • | • |
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| CP-1156 | | \$ 310 | | | | | | Sep-99 | • | |
| CP-1157 | | \$ 170 | | | | | | Sep-99 | • | |
| CP-1158 | | \$ 356 | | | | | | Sep-99 | • | |
| CP-1159 | | \$ 282 | | | | | | Sep-99 | • | |
| | | | | | Pollution Prevention Thrust Area | | | | | |
| PP-1058 | | | | \$1,020* | | Mar-99 | | | | • |
| PP-1075 | \$ 390 | | | | Oct-98 | | | | • | |
| PP-1109 | | \$ 1,000 | | | | Mar-99 | | | | • |
| PP-1110 | \$ 206 | | | | Oct-98 | | | | | • |
| PP-1111 | \$ 614 | | | | Oct-98 | | | | | • |
| TOTALS | \$ 2,616 | \$11,637 | \$ 4,400 | \$ 1,020 | | | | | 19 | 11 |

*Funding recommendation deferred by the SAB

Congressional Earmark

Cleanup Thrust Area

Title:

CU-720: Federal Integrated Biotreatment Research Consortium: Flask to Field Initiative

Performer:

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

Requested Funding:

\$2,300K (FY00 Continuing Project)

Summary:

The objective of this project is to develop a set of practical biotreatment processes for clean up of several classes of contaminants at Department of Defense (DoD) sites. A single panacea technology for all contaminant groups at all sites will not be obtained. All treatment processes have technical and economic limitations, and part of the experimental process of this program will be to define these limitations. Each of the Consortium task leaders was present, and each leader gave a short brief on his technology focus. The technology areas covered were 1) dinitrotoluene (DNT) and trinitrotoluene (TNT) remediation efforts, 2) polycyclic aromatic hydrocarbons (PAH), 3) chlorinated solvents and non-aqueous phase liquids (NAPL), and 4) polychlorinated biphenyls (PCB).

Recommendation:

(March) Board members expressed interest in learning whether the project would receive leveraged funds in addition to private sector funding for the consortium of projects. They noted the importance of having leveraged funds contributed from sources other than the Strategic Environmental Research and Development Program (SERDP) as this project comes to a close in order to ensure continued progress. The Board questioned whether the project should come to completion and whether it was possible that this consortium of projects could be used to address other environmental problems within the DoD. Board members suggested that if the project was to continue, then SERDP should consider whether the consortium format should be changed, possibly following the model of the new SERDP Environmental Management Program (SEMP). A Board member noted that it would be appropriate for the project to move into the next phase of demonstration and validation through the Environmental Security Technology Certification Program (ESTCP). The Board moved to recommend approval of FY00 funding for the project. The motion was approved by a vote of 6-0.

Title:

CU-1081: Genosensor-Based Ecotoxicity Response Assessment

Performer:

Oak Ridge National Laboratory

Requested Funding:

\$850K (FY00 Continuing Project)

Summary:

Within this project, researchers have been developing cost-effective methods and instrumentation for directly monitoring genotoxic exposure in a variety of natural ecosystems. These efforts will expand capabilities for surveillance of toxicity to ecological receptors by incorporating a comprehensive collection of molecular endpoints associated with military-relevant compounds. This will greatly facilitate site characterization, risk assessment, and monitoring of the progress of remediation efforts at DoD and Department of Energy (DOE) installations. Such capabilities for rapid, multispecies biological endpoint monitoring, that are ecologically relevant to cleanup of contaminated sites, should provide a rational basis for reduced cleanup costs. The new technology is expected to enable site closures in a shorter period of time, resulting in significant long-term cost savings.

Recommendation:

(March) Noting that a patent for the genosensor chips had been granted to a private industry company, the Board expressed concern that the technology could stray away from the public domain and stressed that the technology should be readily accessible to the environmental research and development community. Board members opined that even though they were impressed by the project's efforts to develop the technology, it was unclear as to whether this technology would be able to identify soils that are free of contaminants (noting that even if there is a minimum amount of a detectable contaminant in the soil matrix, organisms will always show a response to the contaminant) or even whether the technology could be used in DoD cleanup efforts. Following this discussion, the Board moved to recommend approval of the FY00 funding for this project. The motion was approved by a vote of 6-0.

Title:

CU-1090: Integrated Geophysical Detection of DNAPL Source Zones

Performer:

Blackhawk Geometrics, Inc.

Requested Funding:

\$345K (FY99 Continuing Project)

Summary:

The project's technical objective is to obtain the maximum information on the geological environment using computational geophysics and statistical data interpretation to combine seismic and electrical techniques that will extend two-dimensional capabilities to high resolution three dimension. Sensors will be placed first at the ground surface and then at the subsurface in existing monitoring wells and/or in temporary, minimally-invasive cone penetrometer borings. Complementary direct imaging of dense non-aqueous phase liquids (DNAPL) distribution will be provided by complex resistivity (CR) crosshole tomography using the same downhole electrical sensors.

Recommendation:

(October) The Board was advised that the project received FY98 funding in May of 1998 for a proof-of-concept evaluation. Board members expressed interest in the ability of the technology to detect free-phase DNAPL and questioned whether the detection tool has any limitations with respect to subsurface contaminant depth. While citing the potential benefits of the DNAPL detection system, some Board members expressed scepticism regarding the expected applicability of the proposed technology. This scepticism notwithstanding, the Board members commended the project's progress and the principal investigator's responsiveness to add additional expertise to the project team. The Board moved to recommend approval of the project's FY99 funding. The motion was approved by a vote of 7-0.

Title:

CU-1141: Environmental Toxicology

Performer:

Brooks Air Force Base
Texas Tech University

Requested Funding:

\$2,700K (FY99 Congressional Earmark)

Summary:

There are two objectives of this project. They are the following: 1) to develop a scientifically-based environmental standard of JP-8 jet fuel exposure for the general population at Air Force bases with the intent to characterize potential acute health effects associated with JP-8 and recommend actions to ameliorate disease/injury in exposed personnel; and 2) to perform ecological risk assessment/modeling of contaminant mixtures that will accomplish the following: a) develop/validate aquatic models for assessing effects of water-borne contaminants on aquatic fauna development and reproduction; b) develop and validate terrestrial models to assess the effects of contaminants on terrestrial species development and reproduction; and c) integrate data using models and the geographic information system (GIS) to predict the effects of contaminants on both individuals and populations.

Recommendation:

(October) The project was making its initial briefing before the Board. Several Board members voiced concerns regarding project cost, specifically the high equipment costs proposed under the effort. Citing the lack of a complete research proposal provided to the Board members and the limited briefing material at the meeting as the only information to formulate an opinion, members expressed concern that the research was uncontrolled; that it might proceed in any direction so desired by the principal investigator once the project begins. The Board recognized that the principal investigator had prepared a briefing for the Board quickly; however, it moved not to recommend approval of the funding for the earmark project. This rejection was based on the concerns voiced and an inability of the Board to completely assess the merits of the effort because of the absence of a complete research proposal. The motion was carried by a vote of 6-0-1, with one Board member abstaining from the vote.

Title:

CU-1162: In-Situ Bioreduction and Removal of Ammonium Perchlorate

Performer:

Southern Illinois University

Requested Funding:

\$136K (FY00 New Start Project)

Summary:

The objective of this project is to provide an in-depth study of the microbiology of perchlorate reduction using modern microbiological, biochemical, and molecular techniques. These studies will enumerate and identify predominant perchlorate-reducing bacteria in contaminated subsurface environments. The research team also will identify the important environmental conditions that control the metabolic capabilities of these organisms and determine the rates and threshold values for perchlorate removal over a broad range of these conditions. In addition, the team will investigate techniques for stimulating indigenous perchlorate-reducing bacteria in-situ and develop specific biomarkers for perchlorate reducing bacteria that will aid predictive modeling of in-situ remediation potential of any contaminated site. Finally, this research will determine the ability of these bacteria also to bioremediate co-contaminating organic compounds, such as hydrocarbons or polychlorinated biphenols (PCB), that may be present in the perchlorate-contaminated groundwater environments.

Recommendation:

(August) Board members noted that while perchlorate conversion appears to be straightforward, the real challenge for the project is to ensure adequate mixing between the injected substrate, the perchlorate plume, and the in-situ organisms. They noted the importance of having the mixing process addressed in the development of the in-situ cleanup methods. Board members cautioned that even though researchers may not be able to achieve a cleanup threshold below the regulatory standard of 18 $\mu\text{g/L}$ in the laboratory, significant environmental benefit can be achieved through appreciable reductions of high levels of contaminants. Some members recommended that the researchers focus on achieving successful results at the most contaminated sites, but that a go/no-go decision not be based on a regulatory value. The Board moved to recommend approval of the FY00 funding for this proposal. The vote was 7-0 for approval of the motion.

Title:

CU-1163: In-Situ Bioremediation of Perchlorate

Performer:

Envirogen, Inc.

Requested Funding:

\$289K (FY00 New Start Project)

Summary:

The objective of this project is to develop a biological treatment technology for the in-situ remediation of perchlorate (ClO_4) in groundwater. The experiments proposed in this effort are designed to provide a fundamental understanding of the factors promoting perchlorate degradation in subsurface environments as well as the conditions that inhibit this process. Laboratory microcosms and flow-through model aquifers with sediments and groundwater collected from perchlorate-impacted sites will be used throughout the project.

Recommendation:

(August) Board members noted the importance of subsurface mixing to this project. While some Board members suggested that the proposed modeling be conducted at the beginning of the project to determine how to maximize the mixing of the injected acetate with the ambient groundwater and to determine the costs of the various options, other Board members questioned the utility of computer modeling in addressing this issue. Instead, they recommended that the principal investigators focus on technologies to enhance mixing in the field. In addition, the Board questioned whether there was interest in this technology outside of DoD. The Board moved to recommend approval of the FY00 funding for this proposal, with the recommendation that mixing issues be addressed at the beginning of the project rather than at the end. The vote was 7-0 for approval of the motion as amended.

Title:

CU-1164: In-Situ Bioremediation of Perchlorate-Impacted Groundwater

Performer:

GeoSyntec Consultants Incorporated

Requested Funding:

\$145K (FY00 New Start Project)

Summary:

The technical approach of this project will consist of laboratory microcosm studies and a small-scale field pilot test. For the laboratory component, soil and groundwater will be collected from multiple perchlorate-impacted Federal (e.g., DoD) and defense contractor facilities. Microcosm studies will be conducted to accomplish the following: 1) confirm initial research showing that indigenous groundwater microorganisms can be stimulated to biodegrade perchlorate to environmentally-acceptable end products; 2) evaluate the ubiquity of the process at sites having differing groundwater conditions; and 3) evaluate process suitability for treatment of mixed contaminant plumes containing perchlorate and other common organic chemicals (e.g., chlorinated solvents and petroleum hydrocarbons). Following successful demonstration of perchlorate biodegradation in laboratory microcosms, a small-scale field pilot test will be conducted at one of the test sites to demonstrate that perchlorate can be biodegraded under field conditions and to generate initial design and cost data for potential technology scale-up and transition.

Recommendation:

(August) The Board expressed concern over the need to coordinate research activities among the three new projects involving perchlorate research (CU-1162, CU-1163, and CU-1164), noting that exchanging samples and results among the three projects could introduce variability in the sample collection and analysis protocols. The Board moved to recommend approval of the proposal's request for FY00 funding. The motion was approved by a vote of 7-0.

Title:

CU-1167: Aerobic and Anaerobic Transformation of cis-DCE and VC: Steps for Reliable Remediation

Performer:

Michigan State University

Requested Funding:

\$276K (FY00 New Start Project)

Summary:

This project will investigate both the microbiology and the geochemistry of known degradation pathways for complete destruction to innocuous end-products, with the aim of elucidating the mechanisms, identifying the highest rate conversions, and assessing the potential for stimulating degradation in the field. These pathways include anaerobic chlororespiration, anaerobic energy-yielding oxidation, aerobic co-oxidation, and aerobic energy-yielding oxidation. Mixed cultures capable of complete degradation are available from several sites for use in this project.

Recommendation:

(August) Following discussion by the Board regarding whether the proposal's emphasis was on vinyl chloride (VC) or dichloroethylene (DCE) biodegradation, the Board moved to recommend approval of the proposal for FY00 funding. The motion was approved unanimously by a vote of 8-0.

Title:

CU-1168: Characterization of the Aerobic Oxidation of cis-DCE and VC in Support of Bioremediation of Chloroethene-Contaminated Sites

Performer:

Cornell University

Requested Funding:

\$230K (FY00 New Start Project)

Summary:

This project focuses on aerobic pathways, such as growth-coupled, energy-yielding oxidation, and cometabolic oxidation, that may offer potential for natural or enhanced biological alternatives for the destruction of cis-dichloroethylene (cDCE) and VC at suitable sites. Growth-coupled oxidation in subsurface environments may be more important than currently appreciated. Five candidate sites will be selected based on the likelihood that growth-coupled aerobic oxidation of lesser-chlorinated ethenes is occurring therein. The metabolic capabilities of microorganisms for mineralization of cDCE and/or VC and their distribution in aerobic subsurface environments will be determined. The following two complementary approaches will be taken: microcosm enrichments and direct isolation from the soil, followed by characterization. The possibility that chloroethene degraders are derived from indigenous ethene degraders will be investigated, along with their spatial distribution. The results will delineate the roles of cometabolism versus growth-coupled degradation in the natural attenuation of lesser-chlorinated ethenes and are expected to lead to improved site assessment for remedial actions

Recommendation:

(August) The Board was interested in clarifying how the investigator plans to make a technology out of growth-coupled aerobic degradation. Upon receiving sufficient information outlining the project's technical objectives, the Board moved to recommend approval of the proposal's request for FY00 funding. The motion was seconded and was unanimously approved by a vote of 8-0.

Title:

CU-1169: Factors Affecting cis-DCE and VC Biological Transformation Under Anaerobic Conditions

Performer:

Stanford University

Requested Funding:

\$285K (FY00 New Start Project)

Summary:

This project's technical objectives consist of the following five separate phases of laboratory studies and field sample testing to better understand the reason for incomplete biodegradation: 1) isolate and purify the dehalogenase enzyme(s) catalyzing cDCE and VC reduction, clone the encoding genes, and construct and test a molecular probe for monitoring the genes; 2) test a dual-substrate kinetic model for the reductive dechlorination of cDCE and VC with different cultures using hydrogen as electron donor (go/no-go decision point after year 1); 3) evaluate inhibition of the reductive dechlorination process by end products and/or other chlorinated solvents; 4) develop a field procedure to estimate the availability of hydrogen as electron donor in aquifer samples; and 5) isolate anaerobic cDCE- and VC-oxidizing organisms from enrichment cultures utilizing nitrate, Fe^{3+} , or carbon dioxide (CO_2) as terminal electron acceptors and determine the oxidation kinetics.

Recommendation:

(August) Board members questioned why the major focus of the proposal involves understanding the natural attenuation of cis-DCE and VC rather than developing an engineered process for remediation. Upon receiving assurances from the principal investigator that this focus represents an initial step to clarify the process of natural attenuation and that once this has been researched, efforts will be made to optimize a remediation process, the Board moved to recommend approval of the proposal's request for FY00 funding. The motion was approved by a vote of 7-0-1, with one Board member abstaining from the vote.

Compliance Thrust Area

Title:

CP-819: Improved Incorporation of Health and Safety to Facilitate Accelerated Implementation of Innovative Environmental Technologies

Performer:

National Environmental Education and Training Center (NEETC)

Requested Funding:

\$1,700K (FY99 Congressional Earmark)

Summary:

The objective of this project is to improve the health and safety of workers and communities associated with the implementation of environmental remediation. The project focuses on training workers and providing information to communities regarding health and safety issues related to remediation technologies. For organizations that sponsor the development of remediation technologies (e.g., SERDP), this project seeks to integrate health and safety issues into the design and development stages of the technologies.

Recommendation:

(March) This project is a Congressional Earmark that began in FY94 and was returning to brief the Board and request approval for FY99 earmark funding. It was suggested that the project incorporate a team member with expertise involving the technical aspects of ship building and also consider whether the project's team members have the abilities to understand the deconstruction of ships. Several Board members opined that ship deconstruction is not an area that SERDP represents as a program focus and that this initiative for health and safety processes should fall under the guidance of the Navy. They also noted that the need for a ship deconstruction research and development (R&D) program is not clear. Other Board members opined that this project does incorporate some R&D, including contamination and disposal methods related to the deconstruction of naval ships, that meet Occupational Safety and Health Administration (OSHA) regulations involving worker safety and health. The Board moved to disapprove this project as part of the SERDP program. The motion against approval was carried by a vote of 4-2.

Title:

CP-1106: Characterization of Particulate Emission: Size Characterization and Chemical Speciation

Performer:

University of Utah

Requested Funding:

\$989K (FY00 Continuing Project)

Summary:

This project will develop innovative sampling and analytical techniques utilizing the following instruments: 1) a portable dilution sampler for use with aerosol instruments; 2) an Aerosol Time-of-Flight Mass Spectrometer (ATOFMS) for positive and negative ion detection; 3) a photoelectric detector (PED) for rapid, composite measurement of polycyclic aromatic hydrocarbons (PAH), which are prevalent components of particulate matter (PM); 4) micro-orifice impactors to obtain size-segregated particles for chemical analysis; and 5) standard chemical analyses of filter samples targeted toward likely toxic constituents.

Recommendation:

(September) The Board expressed enthusiasm for the project, and for the project's ability to assemble a good advisory panel. Board members noted that the project had generated useable data, and they were happy to see the excellent progress to date. The Board moved to recommend approval of the proposal's request for FY00 funding. The motion was approved unanimously by a vote of 9-0.

Title:

CP-1132: Thermal Actively Controlled Sludge Treatment

Performer:

NAVAIR

Requested Funding:

\$500K (FY99 New Start Project)

\$1,200K (FY00 Continuing Funding)

Summary:

The project proposes a highly-compact, high-performance, two-stage incineration process comprising the following: 1) the primary vortex containment combustion (VCC) process, which also separates and retains particulates; 2) the self-propagating, high-temperature synthesis (SHS) thermal processing and encapsulation process for treatment of resultant ash; and 3) the actively controlled and monitored after-burner (AB) process for emissions reduction. The process can be automated and integrated into a comprehensive, continuously operated oily water treatment system. This project briefed the SAB twice during FY 1999; once in October of 1998 to request new start funding and once in September of 1999 to request follow-on, second year funding.

Recommendation:

(October) The original project was briefed during the September 1998 meeting, and a funding decision was deferred. It was returning to address concerns raised. Board members asked about the source of the emission data being collected for permitting purposes and the type of constituents that would be monitored. They questioned if any resistance to permitting the proposed integrated system in ports is anticipated, given that it introduces another emissions source, and asked whether the International Maritime Organizations Marine Pollution Convention (MARPOL) currently regulates oil/water discharges. Upon receiving satisfactory information indicating that regulations currently do not exist and that good characterization and monitoring data should provide sufficient evidence to support a no-risk claim, the Board moved to recommend approval of the project for FY99 funding. The motion was approved by a vote of 7-0.

(September) Board members indicated some concern over transitioning the project, asking to whom the product will be provided and how it will be utilized. Several Board members inquired about the inclusion of the contaminated soils portion of the project, indicating that this issue appeared to be outside the scope of this project as funded by SERDP. Having adequately addressed these concerns, the Board moved to recommend approval of the proposal's request for FY00 funding. The motion was approved unanimously by a vote of 9-0.

Title:

CP-1136: Purification of Oily Wastewaters by a One-Step Advanced Biodegradation Process that Produces No Secondary Wastestreams

Performer:

Foster Miller, Inc.

Requested Funding:

\$561K (FY99 New Start Project)

Summary:

This project will develop a one-step, low-maintenance biotreatment process to efficiently destroy organic wastes without producing any sludge. It overcomes the traditional slow-throughput and sensitivity drawbacks of most biotreatment processes by applying a new genetic-enhancement technique for microorganism culture called forced molecular evolution to provide customized microbial isolates targeted toward oily waste components in bilgewater.

Recommendation:

(March) Briefed during the September 1998 meeting, when a decision for funding was deferred, the project was returning to address the concerns raised. Board members noted that using genetically altered organisms for the degradation of recalcitrant compounds would be difficult to achieve and that the manner in which the organisms will be selected to degrade specific recalcitrant target compounds appears unclear. Further, they indicated that because the genetically engineered organisms could not be discharged, they might not work well on a shipboard system. Several Board members opined that they felt uncomfortable with the project and suggested that the principal investigator use the first 18 months to explore whether a consortium of organisms can be found that are able to degrade the components found in bilgewater to acceptable levels. It was noted that the project should not focus on producing new genetic strains of organisms since strains already exist that can be used to meet the projects objectives. It was noted that Dr. Perry McCarty, an absent Board member with expertise in this area, had reviewed the principal investigator's response to the SAB-directed questions from the September 1998 meeting and had indicated that the project should re-address the Board. The Board moved to recommend approval of the project for FY99 funding up to the end of Phase I, allowing for an 18-month study. Board members agreed that when the project re-briefs during FY00, the principal investigator will need to address the concerns raised relating to the ability to achieve a reasonable degradation time in highly polluted oily bilge water. The motion was approved by a vote of 4-2, with two Board members casting negative votes.

Title:

CP-1155: Distribution and Fate of Energetics on DoD Test and Training Ranges

Performer:

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

Requested Funding:

\$405K (FY00 New Start Project)

Summary:

The primary objective of this project is to provide the DoD with techniques to assess the potential for groundwater contamination from residues of high explosives [TNT, Pentaerythrite Tetranitrate (PETN), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)] at testing and training ranges. Results of the project will facilitate informed management decision making, minimize the environmental impacts of testing and training, and contribute to the continued operation of ranges.

Recommendation:

(September) The Board expressed concern over accomplishing project Tasks 2 and 3, which involve environmental fate and transport processes and range compliance assessment, without having groundwater data available as a means of a reality check. Board members expressed concern over the difficulty of determining whether the contaminant is reaching the groundwater, noting the inherent complexity of the vadose zone monitoring. The Board discussed the project reference to the Defense Advanced Research Projects Agency (DARPA) (dog nose project) approach and questioned whether data from DARPA would be used in the revised scope of this project. The Board noted a disconnect between the objective and the proposed approach of the project and questioned the utility of developing wells and investing in modeling procedures similar to those utilized by DARPA. Board members noted that they were unsure of the project scope regarding sampling protocols and analytical methods. They expressed reservations with the information to be assembled in Task 3 (involving range compliance assessment). Board members proposed to move forward and examine the first two project tasks and defer a vote on the third task. The Board moved to recommend approval of the proposal for FY00 funding for the project. However, work on the third task is to be deferred until the project investigator is ready to address the following SAB concerns and questions: 1) identifying available codes and addressing their inadequacies in order to justify the need for another model; 2) identifying the incidence of actual groundwater contamination from firing ranges; and 3) demonstrating the ability of the proposed model to accurately predict field-scale flow and transport through the vadose zone. The motion was approved unanimously by a vote of 9-0.

Title:

CP-1156: Determining the Fate and Ecological Effects of Copper and Zinc Loading in Estuarine Environments

Performer:

Space and Naval Warfare Systems Center

Requested Funding:

\$310K (FY00 New Start Project)

Summary:

The principal objective of this proposal is to develop a methodology for predicting the geochemical fate and ecological effects of copper and zinc loading in estuarine environments impacted by DoD activities. Copper and zinc species will be incorporated in a hydrodynamic estuarine model that simulates the principal estuarine topography, tidally-driven currents, meteorology, and bottom characteristics. The model is used to compute water residence times in the estuary, the key physico-chemical variable against which all other rate-dependant processes are evaluated. Steady-state concentrations of metal species, including the steady-state concentrations of the "free" hydrated metal ion, are computed from the hydrodynamic model, using known or experimentally measured input and sedimentation data for the estuary. The computed steady-state concentrations of copper and zinc species are then compared to the experimental data and the model is fine-tuned by adjusting interspecies reaction (rate) constants until the model is optimized to reproduce the copper and zinc dynamics. The environmental impact of the steady-state concentrations of the toxic copper and zinc species will be evaluated in laboratory tests, as well as through field observations. This work will produce a method for estimating the impact of copper and zinc loading in estuarine environments, in specific mixing zones, and throughout the entire basin.

Recommendation:

(September) Board members were interested in learning which components of the San Diego Bay model would be transferrable to other study areas, in view of the Bay's unique characteristics. The Board inquired as to the status of the project's relationship with the Office of Naval Research (ONR) harbor process program. The Board stressed the need for the three projects (CU-1156, CU-1157, and CU-1158) involving copper and zinc speciation to coordinate their research activities during the first year and noted the benefit of having these three projects work on similar issues. A Board member asked that the three projects brief the Board next year on how the issue of coordination has been addressed. The Board moved to recommend approval of the proposal's request for FY00 funding next year with the provision that it is clearly shown how the analytical issues are being coordinated among the projects to ensure that a common endpoint is achieved. The motion was seconded and was approved by a vote of 9-1.

Title:

CP-1157: Speciation, Fluxes, and Cycling of Dissolved Copper and Zinc in Estuaries

Performer:

University of North Carolina

Requested Funding:

\$170K (FY00 New Start Project)

Summary:

The goals of this project are: 1) to determine quantitatively water column concentrations and benthic fluxes of total dissolved (TD) Cu and Zn, dissolved Cu- and Zn-complexing ligands, and ancillary parameters at two sites in the Cape Fear Estuary; 2) to determine changes in cycling, fate, and organic speciation of dissolved Cu and Zn that may occur during resuspension events, focusing on the role of photochemical reactions; and 3) to examine the effects of a large-scale dredging project on the speciation, fate, and cycling of Cu and Zn in estuarine waters and sediments.

Recommendation:

(September) The Board raised questions regarding the benthic flux sampling and the best method to ensure that the selected sampling sites are representative of various ecosystems, taking into account heterogeneity. Having satisfactorily responded to these questions, the Board moved to recommend approval of the FY00 funding for this proposal. The vote was 10-0 for approval of the motion.

Title:

CP-1158: Speciation, Sources, and Bioavailability of Copper and Zinc in DoD-Impacted Harbors and Estuaries

Performer:

University of Wisconsin

Requested Funding:

\$356K (FY00 New Start Project)

Summary:

The objectives of this project are the following: 1) to apply and refine methods for speciation of Cu and Zn in harbor and estuary waters, including the determination of the following: the distribution among dissolved, colloidal, and particulate phases; the speciation of filterable phases into free ion, labile, and strong complexes; and the stability constants of dominant complexes or associations and their incorporation into models of bioavailability; 2) to assess the influences of environmental factors and processes on the speciation and fate of Cu and Zn including: the nature and forms of dissolved organic carbon and other colloidal and particulate phases, ionic strength gradients, and biotic activity; 3) to interpret experimentally determined lability estimates of dominant metal-complexes in terms of time scales relevant to biological and physical processes in DoD-impacted harbors; 4) to compare modeled estimates of bioavailability of specific phases with biochemically determined exposure on experimental organisms; and 5) to determine sources of Cu and Zn to harbors and estuaries using a multi-faceted approach of selective sampling, metal phase discrimination, and unique stable isotopic signatures to distinguish DoD sources of Cu and Zn from other sources to harbors and estuaries.

Recommendation:

(September) A Board member expressed concern that the research appeared empirical and questioned how the researchers would be able to draw generalizations and determine applicability to different areas. Noting that the research team consisted primarily of aquatic specialists, Board members asked questions regarding the research laboratory's qualifications in regard to working with marine bioassays in salt water environments. The Board asked questions to determine how the ligands would be adequately characterized, asking that the principal investigator elaborate on the field sampling protocol. A Board member encouraged the team not to ignore the sampling plan issues dealing with the fact that seasonal fluctuations in harbors and estuaries can be quite pronounced. The Board moved to recommend approval of the FY00 funding for this proposal with the requirement that the project provide a report after one year that addresses Board concerns regarding bioassays, speciation, and fractionation results. The vote was 9-1 for approval of the motion.

Title:

CP-1159: A Predictive Capability for the Source Terms of Residual Energetic Materials from Burning and/or Detonation Activities

Performer:

Aerodyne Research, Inc.

Requested Funding:

\$282K (FY00 New Start Project)

Summary:

This project will develop an improved predictive capability, termed a Source Characterization Model (SCM), for Open Burn/Open Detonation (OB/OD) emission sources. The SCM will allow DoD to assess effectively the environmental impacts of OB/OD activities at test and training ranges. The proposed effort focuses on the quantification of the source terms that include the deposition of energetic material itself, combustion products, and any breakdown products on the ground or in surface waters. The source information for various munitions explosion scenarios and meteorological conditions then can be used to perform transport and dispersion analysis of toxic materials in air, soil, and water environments.

Recommendation:

(September) Board members noted that many variables pertaining to the research had not been discussed in the briefing (i.e., incomplete combustion, the molecular weight in the model, the manner in which gases rise in different geological areas), and questioned how numerous variables could be incorporated into the model. Board members also expressed interest regarding database development and the manner in which the data collected would be incorporated. Following the discussion, the Board moved to recommend approval of the proposal's request for FY00 funding. The motion was approved by a vote of 9-0.

Conservation Thrust Area

Title:

CS-1098: Emerging and Contemporary Technologies in Remote Sensing for Ecosystem Assessment and Change Detection on Military Reservations

Performer:

University of Nevada
U.S. Army Topographic Engineering Center

Requested Funding:

\$1,130K (FY00 Continuing Project)

Summary:

This project will accomplish the following: 1) use emerging, contemporary and historical remote sensing technologies to stratify the landscape's of individual military ranges; 2) develop methods to identify the fundamental vegetation and soil attributes of military ranges as they relate to plant succession; 3) perform a retrospective study with spatially-explicit spectral-based indices of ecosystem response and recovery of disturbance; 4) examine the spatial, spectral, and temporal attributes of remote sensing systems necessary to identify ecotones and to distinguish along environmental and disturbance gradients; and 5) develop methods for scaling indices between coarse and fine resolution imagery.

Recommendation:

(March) The Board questioned how Remote Sensing (RS) would be used in the modeling aspect of the project both to manage DoD landscapes and to implement future ecosystem management and inquired as to the criteria needed to determine which sites can be studied utilizing RS data. It was noted that RS data may not be useful in determining cause and effect relationships within an ecosystem and that the cause and effect data will be hard to extrapolate from the Environmental Monitoring and Assessment Program (EMAP) and the Land Condition Trend Analysis (LCTA) Program. Board members suggested that the project investigator address this issue next year when the project returns to brief the SAB for FY01 funding. The Board moved to recommend approval of the project's request for FY00 funding and required that the project accomplish the following: 1) provide a description of the cause and effect relationship that will be identified with LCTA and RS technologies, 2) provide the SAB with documentation of the proposed models, preferably before the next meeting, 3) provide updated information of the interim report to the SAB during the project's next briefing, and 4) provide a practical example of how the data acquired would be used by a military base to improve military operations. The motion, which included the recommendations, was approved by a vote of 6-0.

Title:

CS-1114: SERDP Ecosystem Management Program (SEMP)

Performer:

U.S. Army Engineering Research and Development Center - CERL

Requested Funding:

(Informational Briefing)

Summary:

During FY98, the SEMP was established to implement the following four major program goals: 1) address DoD requirements and opportunities in Environmental Management (EM) research, as identified by the 1997 SERDP Management-Scale Ecosystem Research Workshop; 2) establish a long-term research site (or sites) on DoD lands and waters for DoD-relevant ecosystem research; 3) conduct ecosystem research and monitoring activities relevant to DoD requirements and opportunities; and 4) facilitate the integration of results and findings of research into DoD EM practices. SEMP focuses on the maintenance and improvement of land sustainability and native biological diversity in support of the DoD military mission.

Recommendation:

(March) Board members suggested the project should conduct lessons-learned analyses and workshops more frequently than the proposed 3-year interval, e.g. at 18-month intervals to provide updated information to the end users of the monitoring tasks. Board members suggested that the Technical Advisory Committee (TAC) incorporate individuals from outside DoD and DOE and broaden communications with other environmental and academic communities. A Board member noted that this type of initiative had been proposed before by the National Science Foundation (NSF) in its Long Term Ecological Research (LTER) program and that the initiative was not successful in establishing individual research efforts and moving data to the larger community. The Board member suggested that SERDP watch this program very closely and incorporate lessons learned from NSF to assure that the project is successful and fulfills its long-term monitoring objectives.

Title:

CS-1143: Application of Hyperspectral Techniques to Monitoring and Management of Invasive Weed Infestation

Performer:

University of California

Requested Funding:

\$410.3K (FY00 New Start Project)

Summary:

The approach will combine field sampling, remote sensing, and GIS technology using applied research techniques in an integrated approach to monitor and predict the expansion of noxious weeds. Hyperspectral Imagery (HSI) techniques will be used to develop enhanced inventory and monitoring tools for differentiating noxious weeds and native species. Protocols will be developed for using HSI data suitable for use with DoD sensors (i.e., Warfighter and NEMO), NASA's Hyperion on the EO-1 satellite, and Australia's AIREH HSI satellites.

Recommendation:

(August) Board members expressed concern that the ecological parameters in the proposal are not well articulated and asked the investigators to consider such parameters as; the mix of native and exotic species, the rate of spread, the disturbance regime, and land use history so that the monitoring capabilities that are developed can be used in a predictive manner. Board members were interested in learning whether mutual support existed between this project and other SERDP new start efforts that focus on the same subject, specifically project CS-1145. Several Board members suggested that the investigators consider the land use history and the history of soil disturbance, in order to facilitate movement toward development of a predictive tool. Other Board members expressed concern over the cost of this proposal, questioning whether current technology weren't sufficient to accomplish this. Following this discussion, the Board moved to recommend approval of FY00 funding for the proposal. The motion was approved by a vote of 7-1.

Title:

CS-1144: Exotic Annual Grasses in Western Rangelands: Predicting Resistance and Resilience of Native Ecosystem Invasion

Performer:

U.S. Geological Survey, Canyonlands Field Station

Requested Funding:

\$311K (FY00 New Start Project)

Summary:

This project will determine if invasion susceptibility can be predicted by variations in soil characteristics attributable to geomorphic and pedogenic processes within a given watershed. Experiments will be conducted to determine if managers can alter soil chemistry in a way to favor native grass establishment. The proposed research will monitor soils in a newly-invaded area and document what alterations in soil chemistry and biology occur. Results will be used to develop management strategies to avoid new *Bromus* invasions and, for already-invaded areas, to develop techniques to enhance native plant reestablishment.

Recommendation:

(August) Board members encouraged the investigators to collaborate with Dr. Paschke, the principal investigator for SERDP project CS-1145, and, in particular, to analyze the underlying mechanisms at work in the undisturbed sites in light of Dr. Paschke's restoration results. The Board also recommended adding a microbial ecologist to the team because gathering such data would contribute to the understanding of the underlying mechanisms and complement the work of Dr. Paschke. A Board member suggested that the investigators look at the distribution of organisms in the soils and that principal investigator contact Dr. James Teidje of Michigan State University to request guidance on selecting the best available technique. The Board moved to recommend approval of FY00 funding for the proposal with the requirements that the investigators contact Dr. Tiedje to help determine the best technique available for looking at the distribution of organisms in soils. The motion was approved by a vote of 8-0.

Title:

CS-1145: Integrated Control and Assessment of Knapweed and Cheatgrass on DoD Installations

Performer:

Colorado State University

Requested Funding:

\$401K (FY00 New Start Project)

Summary:

The objective of this project is to test a combination of manipulations that accelerate the natural recovery process of disturbed land, thereby reducing the risk of invasion. The following types of manipulations that accelerate natural secondary plant populations in disturbed areas will be tested: 1) reduction of the pest plant population using biological control or burning, 2) reducing soil nitrogen availability, 3) reseeding with desirable mid- and late-seral plant species, and 4) reintroduction of a native late-seral soil microbial community. Fort Carson, CO, and Yakima Training Center, WA, will be used as test sites. Research plots will be monitored using new generation remote sensing techniques to develop methods for assessing the status of weed populations and the large-scale effectiveness of control technologies. Using DoD's existing ecosystem dynamics simulation model (EDYS), results will be extrapolated to larger spatial and temporal scales in order to develop a general strategy for managing these non-indigenous species on DoD lands in the western United States.

Recommendation:

(August) Board members expressed interest in the investigator's plan to acquire gradient and density information from spectral data, noting that the military already has these data from other sources. The Board also suggested that the investigators should consider supplementing the test plot data with other available data for established transects in the event that the results of changes instituted at the test plots are inconclusive. Board members encouraged the investigators to collect land use history data and current disturbance data to correlate with the location of invasives and to coordinate with Dr. Ustin, the principal investigator for SERDP project CS-1143, on the remote sensing aspects of this project. The Board cautioned the investigators that ground-truthing their remote sensing data will be of the utmost importance. Several members of the Board expressed concern at the high cost of acquiring remote sensing data for this proposal. The Board requested that the investigators for these conservation projects (CS-1143, CS-1144, CS-1145) coordinate among themselves in an effort to reduce the cost of remote sensing data acquisition. The Board moved to recommend approval of the FY00 funding for this proposal. The motion was approved by a vote of 9-0.

Title:

CS-1146: Developing Biological Control of Garlic Mustard

Performer:

Cornell University

Requested Funding:

\$162K (FY00 New Start Project)

Summary:

The investigators intend to study, in Europe, the ecology, life history, and impact of the insects to be used as biological controls and to determine their host specificity. Additionally, the effort will develop and test a standardized monitoring protocol for follow-up studies incorporating target weed and insect control agents and native plant communities.

Recommendation:

(August) In response to Board member concerns involving the risk of introducing a new insect species, the SERDP Executive Director explained that this project would only study the effects of selected insects in a controlled greenhouse environment in an overseas location. These insects would not be introduced into the environment during the project. Introduction of these insects would be under the purview of the U.S. Department of Agriculture. The Board indicated that although invasive species are an important environmental issue at military facilities, this proposal does not really develop a new technique. The proposal itself does not move the theory of biological control agents forward, although it does look for a very practical solution to a current invasives problem. The SERDP Executive Director agreed, noting that although this project does not develop cutting-edge technology, SERDP has occasionally funded projects that are not strategic in nature but are likely to produce tools quickly to be used on DoD sites. The Board moved to recommend approval of FY00 funding for the proposal. The motion was approved by a vote of 6-1.

Pollution Prevention Thrust Area

Title:

PP-1058: Elimination of Toxic Materials and Solvents from Solid Propellant Components

Performer:

U.S. Army Aviation and Missile Command

Requested Funding:

\$1,020K (FY00 Continuing Project)

Summary:

The objective of this project is to eliminate major sources of toxic/hazardous materials used in missile systems. This will be accomplished by implementing pollution prevention research in the following two areas: 1) Green Energetics: (a) eliminate lead as a ballistic catalyst in minimum signature propellants and (b) eliminate hydrochloric acid (HCl) as a combustion product of tactical and strategic booster propellants; and 2) Clean Energetic Processing: Develop energetic oxidizer processing methods which do not require volatile organic compounds (VOC) and toxic materials.

Recommendation:

(March) A Board member expressed concern that the project had not considered the potential effects regarding the following alternative chemicals: bismuth, ammonium dinitramide (AND) and ultrafine aluminum (UFAL), saying that the chemicals could have an impact on the environment. Of particular concern was bismuth. The project had not fully explored the potential environmental risks involving bismuth, as it was directed to do during a previous SAB meeting. Board members noted that a risk assessment should not only include human health risks, but also ecological toxicity assessments. Board members provided examples of the types of data that are needed for the environmental risk assessment. These included the following: 1) toxicological data for potential ecosystems that are affected, 2) environmental impacts on an ecosystem including concentration levels that could be harmless/harmful, 3) the potential for bioaccumulation, 4) possible exposure pathways, and 5) an overview of the environmental chemistry of bismuth. A Board member suggested that the project take the environmental risk assessment into consideration before testing begins and that a goal of the SAB is to make sure that adequate precautions are taken to avoid any future DoD environmental cleanup issues. The Board moved to require that the project investigator provide written documentation, to be forwarded to several Board members for review, explaining the environmental behavior and impact of bismuth. After review, these members will provide an overview to the remainder of the Board. The motion was approved by a vote of 4-0. The Board then moved to defer the approval of FY00 funding until the other Board members have been briefed regarding the environmental risks associated with bismuth. The motion was approved by a vote of 4-0.

Title:

PP-1075: Replacement Non-Toxic Sealants

Performer:

Air Force Research Laboratory - Wright Patterson Air Force Base

Requested Funding:

\$390K (FY99 New Start)

Summary:

The objective of this project is to identify candidate replacement non-chromated sealants that meet the requirements of MIL-SPEC-81733C. Chromium-free, fast curing, non-VOC, and lighter weight materials will be developed, tested, and transitioned. The new nontoxic sealants will be tested on KC-135 and B-52 aircraft in coordination with Tinker Air Force Base (AFB) and on F-18 aircraft at Naval Air Warfare Center, Patuxent River, to demonstrate performance.

Recommendation:

(October) The Board expressed interest in learning how extensive the MIL-SPECs' chromate requirements are and how the proposed project would address those requirements. They requested clarification on whether any programs/projects exist to screen the hazardous materials in the MIL-SPECs and prioritize them. The Board moved to recommend approval of the project's request for FY99 funding. The motion was approved by a vote of 7-0.

Title:

PP-1109: Non-Polluting Composites Repair and Remanufacturing for Military Applications

Performer:

U.S. Army Research Laboratory

Requested Funding:

\$1,000K (FY00 Continuing Project)

Summary:

The technical objective of this program is to research, develop, and demonstrate a unique, affordable, and environmentally friendly family of polymer-matrix composite (PMC) manufacturing and repair technologies for stand-alone repair of current, soon-to-be-fielded, and future DoD structures. Pollution prevention technologies associated with vacuum-assisted resin transfer molding (VARTM) and various curing technologies, including electron beam and ultraviolet light curing of composites and adhesives and recycling of fabric preregs, will be advanced. Repair concepts and technologies will be demonstrated on three DoD-specific problems, including the design and implementation of a non-autoclave repair procedure for the oft-repaired Army's helicopter rotor blades and the development, demonstration, and documentation of a repair-friendly processing method for the remanufacture of the Navy's future fielding of the Advanced Enclosed Mast/Sensor System (AEMSS), which includes the multi-functional material development of several advanced concepts for non-autoclave repair of aircraft skins for the Air Force and Navy.

Recommendation:

(March) Board members complimented the project for addressing questions raised at previous SAB meetings, noting that the answers to those questions have helped the project focus on specific DoD environmental issues. It was recommended that the project increase its focus on providing the scientific community more information in the form of published reports/articles. The Board moved to recommend approval of the FY00 funding for this project. The vote was 4-0 for approval of the motion.

Title:

PP-1110: Genetic Enhancement of an Anti-Freeze Protein for Use as a Substitute for Ethylene Glycol for Aircraft Deicing

Performer:

Aspen Systems, Inc.

Requested Funding:

\$206K (FY99 Continuing Project)

Summary:

The project's technical objectives are to produce novel deicing and anti-icing agents using naturally occurring antifreeze proteins, which have a very low biological oxygen demand (BOD) compared to current agents. Initial research has indicated that the *Dendriodes canadensis* protein found in insects produces a freezing point depression that is 300 to 500 times the predicted value based on its molal concentration resulting from non-colligative properties. This project proposes to genetically alter the *Dendriodes canadensis* antifreeze protein gene in order to enhance the freezing point depression capabilities and, therefore, increase its usefulness and value as an aircraft deicing/anti-icing agent.

Recommendation:

(October) Board members expressed concern that the addition of proteins containing nitrogen and phosphorous could increase eutrophication issues due to runoff into surrounding watersheds and ecosystems. One Board member felt uncomfortable with the project and cited the following concerns: 1) the absence of a scientific approach to identify the freezing point depression, 2) the program does not address the environmental impacts and cannot discern whether the proteins will be truly benign within the ecosystem, and 3) the approach/protocol for field testing has not been clearly identified. Board members agreed that the environmental impacts need to be more clearly addressed, including the nitrogen loading issue. At the same time, testing of the proteins may be a problem since the protocol for testing proteins has not been identified. The Board moved to recommend approval the project's request for FY99 funding for one year to reach the go/no-go decision point. The vote was 6-1 for approval of the motion.

Title:

PP-1111: Environmentally Advantaged Substitutes for Ethylene Glycol for Aircraft Ice Control

Performer:

Foster-Miller, Inc.

Requested Funding:

\$614K (FY99 Continuing Project)

Summary:

The overall objective of this project is to develop a high performance, environmentally benign aircraft anti-icing fluid which can be safely released to the environment without post-treatment. Specific technical objectives include the following: 1) to develop a molecular modeling approach which allows for the prediction of non-Newtonian viscosity behavior of materials based on their chemical structure; 2) to develop a nontoxic, non-Newtonian thickening agent with enhanced performance capabilities for anti-icing fluids, to be used particularly during extended holdover times; 3) to select low-impact environmental performance-enhancing additives; 4) to demonstrate that the anti-icing formulations are compatible with aircraft materials; 5) to demonstrate the ability of the anti-icing formulations to prevent ice formation for extended periods of time in simulated adverse weather environments; 6) to develop encapsulated enzyme additives which exhibit controlled release properties and actively degrade the anti-icing formulation at reduced temperatures; 7) to predict the water quality impact of new anti-icing formulations at actual airfield sites using computer modeling and laboratory analysis of key environmental parameters; 8) to determine any potential health/safety risks of anti-icing formulations; and 9) to develop cost-effective anti-icing formulations by screening out excessively costly materials throughout the testing program.

Recommendation:

(October) Board members expressed concern that the potential release of biologically active enzymes into the environment could potentially cause resistance from environmental groups. They encouraged the project to follow a pro-active approach with respect to upcoming requirements, i.e., to consider future water quality initiatives and potential new regulatory requirements as part of the environmental evaluation. It was suggested that the project include chronic testing along with acute testing on the new formulations. Board members also expressed reservations about the use of a proprietary model, given that alternatives are available. The Board moved to recommend approval of the FY99 funding for this project, with the caveat that the project would incorporate the comments made by the Board, especially those related to the proposed evaluation of environmental impact as the project progresses. The SAB requested a re-brief prior to approval of FY00 funds. The vote was 5-2 for approval of the motion.